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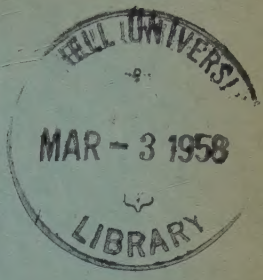

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MELBOURNE

THE CHOICE OF COMMUNAL OVIPOSITION SITES BY THE AUSTRALIAN SHEEP BLOWFLY *LUCILIA CUPRINA*

By L. Barton Browne*

[*Manuscript received June* 27, 1958]

Summary

Large groups of eggs representing the oviposition of a number of females of *Lucilia cuprina* are frequently found on fleece preparations. Females were shown to have a preference for ovipositing in cavities in the fleece, especially those near the moist cotton-wool plugs. The cavities are primarily attractive as places of high humidity and low illuminance. Of secondary importance is the preference of females for laying at places where other females are already ovipositing.

I. Introduction

After laboratory populations of *Lucilia cuprina* (Wied.) were presented with a number of sites suitable for oviposition, it was found that there were, at certain of these, large groups of eggs, representing the oviposition of a number of females, whereas there were few or no eggs at others (Mackerras and Mackerras 1944). The experiments described in this paper were done to examine the factors stimulating a number of females to lay their eggs in the same place. The possibilities investigated were (1) that the flies may prefer certain sites on the preparations provided; (2) that either the eggs themselves or a chemical "factor" produced during their laying may stimulate females to oviposit; and (3) that, as suggested by Cragg (1956) for certain British species of *Lucilia*, the presence of ovipositing females may stimulate other females to lay near them.

II. Materials and Methods

All experiments were done in a room maintained at 80°F and equipped with fluorescent lights. The cages in which the flies were confined measured 18 by 16 by 16 in. The flies were given fresh liver as a source of protein on the second and third days after emergence and in most experiments were used when 10 days old. Hobson (1936) showed that flies would oviposit in fleece only in the presence of putrefying matter or its equivalent. Hence the preparations supplied for oviposition were similar to those used by Mackerras and Mackerras (1944) and consisted of 150-ml beakers each containing freshly cut Merino fleece with a cotton-wool plug, soaked in a solution of 0·04 per cent. indole and 2 per cent. ammonium carbonate, standing vertically in it. The plugs were made by adding 15 ml of this solution to a 2-in. square of cotton wool rolled to form a cylinder of diameter $\frac{2}{3}$ in.

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III. Design of Experiments and Results

(*a*) *The Role of Cavities*

Flies most frequently lay their eggs in the cavities between the fleece and the moist plugs or between the staples (Rogoff and Barton Browne 1958). The following experiments were designed to evaluate the importance of these cavities in determining where eggs would be laid and also to determine what characteristics of the cavities were attractive to the gravid females. In these experiments cavities about $\frac{1}{2}$ in. in diameter and $\frac{3}{4}$ in. deep were made in the preparations. Unless otherwise stated, the relative humidity (R.H.) in the room was about 30 per cent. The percentages given below are means derived from at least six cages of flies in which a total of over 500 egg masses were laid.

The percentage of the total number of egg masses laid in cavities was first determined. When each preparation had a single cavity which was against the indole and ammonium carbonate plug, 97 per cent. of the egg masses were laid in the cavities. When the plug was eccentrically placed and the cavity made on the opposite side of the preparation from it so that about $1\frac{1}{2}$ in. of fleece separated the two, the cavities received only 77 per cent. of the total number of egg masses. The remainder were in the narrow space which inevitably existed between the fleece and the plug. This result differs significantly ($P<0{\cdot}01$) from that obtained for cavities near the plug.

It would appear from the above results that either the moisture level or the proximity to the indole and ammonium carbonate, or both, caused cavities near the plug to be more attractive as sites for oviposition than cavities at a distance from the plug. This was investigated further in the following series of experiments.

Six preparations in which the cavity was near the plug and six preparations in which the cavity was at a distance from the plug were placed in each of a number of cages. Ninety-seven per cent. of the egg masses were laid in the cavities near the plugs.

The role of moisture in making the cavities near the plugs more attractive was investigated as follows. Two types of preparations were presented to the flies. In both, the cavity was as far from the plug as possible, but in one a pad of water-soaked cotton wool was placed so that it formed one side of the cavity. Six of each of these types of preparations were placed in each cage. The cavities with moist cotton wool received 98 per cent. of the eggs laid.

An experiment was next done to determine whether cavities adjoining the indole and ammonium carbonate plugs were more attractive than those adjoining water-soaked cotton wool. It was found that 48 per cent. of the eggs were laid in the cavities near the water-soaked cotton wool and 47 per cent. in those near the indole and ammonium carbonate. The remaining 5 per cent. were near the indole and ammonium carbonate plugs of the preparations which had the cavity adjoining the water-soaked cotton wool. The preference shown above for cavities near the plug was therefore due to the presence of moisture and not to the presence of indole and ammonium carbonate.

An experiment was carried out to determine whether the attractiveness of cavities distant from the plugs depended on their being places of higher humidity than the surrounding air. Fleece was allowed to remain for 24 hr in a chamber in which the R.H. was 50 per cent. Preparations, each with a cavity as far from the plug as possible were made from this fleece. The percentage of the total number of eggs laid in the cavities was determined under R.H.'s of 30, 50, 75, and 95 per cent. The findings are tabulated below:

Relative Humidity (%)	Total No. of Eggs Laid (%)
30	82
50	42
75	20

At 95 per cent. R.H. the flies showed no special preference for the cavities. At R.H.'s of 50, 75, and 95 per cent. many of the eggs were laid on the indole and ammonium carbonate plugs. The relative attractiveness of cavities in desiccated fleece and in fleece which had been kept in a R.H. of 50 per cent. was next assessed. When flies were given a choice under 30 per cent. R.H., all eggs laid in cavities were on the preparations made from undesiccated fleece. The few eggs laid on the preparations made from desiccated fleece were near the plug. Desiccated fleece which had been allowed to re-absorb moisture from the air received as many eggs as undesiccated fleece.

These results indicate that cavities are highly attractive as oviposition sites only when the air in them has a higher moisture content than the surrounding air. The fact that at R.H.'s of 50 and 75 per cent. the cavities in fleece kept at 50 per cent. R.H. were more attractive than equal areas of the general fleece surface suggests, however, that the flies found other characteristics of the cavities attractive. These could include the higher concentrations of fleece odour, suitable tactile stimuli, and reduced illuminance. Of these, only the latter seemed susceptible of direct investigation.

To test whether the reduced illuminance at the bottom of the cavity was a factor in its attractiveness, preparations were made in which the cavity was against the glass of the beaker so that fleece formed three sides of the cavity and glass the fourth. In half of these preparations a piece of black paper was taped to the outside of that part of the glass which formed the side of the cavity. In these the illuminance was low as compared with that in those not covered. It was found that 70 per cent. of the egg masses were laid in the cavities in which the illuminance was lower, i.e. flies about to oviposit showed a preference for places where illuminance was lower than that of the surrounding area.

(*b*) *The Effect of the Presence of Ovipositing Females*

The experiments described in this section were done to determine whether the presence of ovipositing females, or eggs, or of some other factor deposited during oviposition had any influence in determining where other females would lay.

Flies were given the choice of two types of preparations on which to oviposit. Each had a single cavity against the indole and ammonium carbonate plug. In one

series each cavity contained four living female flies attached to the heads of nails by paraffin wax. In the other series the cavities were empty. In all 10 experiments there were more egg masses laid in the cavities which held the flies, these cavities receiving 82 per cent. of the egg masses laid. This result shows clearly that the presence of female flies situated in cavities stimulated other females to lay near them. When groups of female flies attached to nails were placed on the general fleece surface, i.e. not in cavities, they received very few eggs. It was also shown that the presence in cavities of nails with waxed heads slightly reduced the amount of egg laying.

TABLE 1

NUMBER OF EGG MASSES LAID IN CAVITIES CONTAINING OVIPOSITING FEMALES AND IN CLEARED CAVITIES

(1) No. of Females in Cage 2 Found to have Laid	(2) No. of Egg Masses Laid by Flies in Cage 2 in Cleared Cavities	(3) No. of Egg Masses Laid by Flies in Cage 2 in Cavities Containing Flies [(1)−(2)]	(4) Excess No. of Egg Masses Laid in Cavities Containing Flies [(3)−(2)]
60	20	40	20
52	21	31	10
48	16	32	16
50	17	33	16
48	18	30	12
25	13	12	−1
29	10	19	9
63	19	44	25
62	20	42	22
21	11	10	−1
40	15	25	10
58	19	39	20
26	7	19	12
21	9	12	3
22	13	9	−4
34	11	23	12
27	15	12	−3
48	11	37	26
66	16	50	34
45	12	33	21
55	10	45	35

In the previous experiment the situation examined was one in which the cavities necessarily contained flies throughout the experiment and in which these flies were not ovipositing. The following experiment was carried out, therefore, to determine the effect of allowing all flies freedom of movement. Eight preparations, each with one cavity near the plug, were placed in a cage (cage 1) containing a large number of flies which had been marked with fluorescent dust (Norris 1957) and were allowed to remain there until stable groups of ovipositing females had formed in all cavities. This usually took between 15 and 30 min. The preparations were then

removed and all the flies cleared from the cavities of four of them. Egg masses consisting of more than about 20 eggs were counted and the preparations reformed. In the other four preparations, four flies were allowed to remain in each of the cavities. The eight preparations were transferred to a cage (cage 2) containing about 150 gravid females. After 1 hr the preparations were removed and the egg masses in the cavities of the four preparations from which the flies had been cleared again counted. The flies in cage 2 were killed, the unmarked ones dissected, and the number of females which had laid more than about 20 eggs recorded. Twenty-one replicates of the experiment were done. If there were no bias in favour of the cavities containing ovipositing females it could be expected that, on the average, the number of additional egg masses laid in them by the flies in cage 2 would be just half the number of females found by dissection to have laid. It had been found previously that the number of egg masses was an overestimate of the number of females which had laid. The values given in Table 1 for the number of egg masses obtained by counting are corrected values found by multiplying the number obtained by direct counts by $\frac{3}{4}$ and the results of the 21 individual replicates are shown. In 16 of these the number laid in the cavities containing ovipositing females exceeded by a considerable amount that in the cleared cavities. In the other five, the egg laying in each type of cavity was approximately the same. This result indicates that in most cases the presence of ovipositing females caused the other females to oviposit near them.

An experiment was done to determine whether flies were attracted to lay by the presence of eggs or by any other factor deposited by the ovipositing females. In this experiment preparations were placed in a cage containing a large number of flies and were allowed to remain until a number of egg masses had been laid in the cavity of each. On removal the number of egg masses was counted and the preparations reformed. Four of these preparations and four preparations which had not been contacted by flies were placed in cages containing about 150 gravid females. After 1 hr the preparations were removed from the second cage and the egg masses counted. It was found that the cavities already containing eggs received 47 per cent. of the eggs laid by the females in the second cage. Eggs and other factors possibly deposited by ovipositing females therefore did not influence egg laying.

IV. Discussion

The experiments described in this paper show that two factors explain the laying of large numbers of egg masses in certain places on fleece preparations. Of these the preference of the fly for laying in cavities seems the more important. The evidence for this is (i) that suitable cavities received nearly all the eggs laid whereas, when the flies were given a choice of cavities containing flies and empty cavities, they laid only about 80 per cent. of their eggs in the former; and (ii) that few or no eggs were laid among the flies which were not situated in cavities. Also, the presence or absence of cavities largely determined whether eggs would be laid or not (Rogoff and Barton Browne 1958), whereas evidence is available that the presence of females merely controls the placing of the eggs laid by a given group of flies.

These findings amply explain the highly variable results that have frequently been obtained in the assessment through amount of oviposition of the effectiveness of repellents on sheep. Otherwise attractive situations could have been unsuitable for oviposition merely because of the absence of suitable cavities. Variations due to the presence or absence of cavities are amplified by the attractiveness of already ovipositing females. In quantitative experiments dealing with oviposition on fleece it is therefore of great importance to make an attempt to standardize the presence of cavities and to bear in mind that, while the first eggs laid are the result of the attraction of gravid females by the preparation itself, the laying of later ones is in part due to the presence of already ovipositing flies. These latter egg masses, therefore, should be given less weight in assessing the suitability of sites for oviposition.

The flies' habit of laying in groups has survival value for the eggs and young larvae on sheep. Eggs laid on fleece are always in great danger of death through desiccation. Cragg (1955) has pointed out that, under fairly dry conditions, the inner eggs in a large clump made up of many egg masses would survive and that the survival of first-stage maggots which are also susceptible to desiccation would depend on how quickly they can cause an exudation from the skin of the sheep. A large number of maggots would accomplish this in a shorter time than would a few. These comments would apply, but probably to a lesser extent, to eggs laid on carrion.

It will have been observed that in none of the above experiments was a variance given for the results. This was because the variance was often very high due to the "all or nothing" nature of the factors studied. For instance, in studying the effect of the presence of already ovipositing females it was found that most times large egg masses were laid on the flies placed in cavities but that occasionally a "group oviposition" would develop in an empty cavity in which a female had by chance begun ovipositing early in the experiment. It was more meaningful, therefore, to give the results as total percentages obtained from a number of replicates.

V. Acknowledgments

I wish to give special thanks to Dr. W. M. Rogoff of South Dakota State College who collaborated with me in the early part of the work described. It was during this period of collaboration that the basic idea behind this research was first suggested. Some preliminary experiments on the matters reported were carried out during Dr. Rogoff's stay in Canberra. Thanks are also due to colleagues at the Division of Entomology, C.S.I.R.O., Canberra, and at the Department of Biology, Johns Hopkins University, Baltimore, for their criticism of the manuscript. Mr. A. van Gerwen is also thanked for assisting in the experiments and for carrying out some of them.

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VARIATION AND SPECIATION IN THE AUSTRALIAN CAMPEPHAGIDAE (PASSERES)

By A. Keast*

[*Manuscript received August* 11, 1958]

Summary

The present paper reviews the taxonomy of and discusses speciation in the Australian members of the family Campephagidae (cuckoo-shrikes and trillers), embracing the genera *Pteropodocys* Gould, *Coracina* Vieillot, *Edolisoma* Pucheran, and *Lalage* Boie.

Isolates are few in number on the continent. This presumably results from most species having rather generalized habitat requirements, continuous ranges, being large and mobile, and undertaking seasonal wanderings.

Four of the species extend widely through the tropical islands to the north. An archipelago area of about the same size as Australia provides an interesting contrast with the continent, there being some 35 morphologically differentiated isolates as against 7–10 on the latter. Tropical islands (with a constant supply of food all the year round ?) apparently favour the development of the sedentary way of life and isolation, just as the drier conditions of Australia favour nomadism and the maintenance of breeding continuity. The bulk of the insular forms, however, are small populations with restricted ranges, and must lack the adaptive gene pool of their continental congeners. Because of this their evolutionary future is presumably limited.

Attention is drawn to an interesting comparison between two species that undertake equally extensive seasonal movements. One, *Lalage sueurii*, does not vary at all geographically, but the second, *Coracina novaehollandiae*, has marked clinal variation and two, possibly three, isolates. The reasons for this are discussed. The point is made that seasonal movements *per se* may not prohibit the development of geographic variation but that this depends on the nature of the movements.

I. Introduction

The eight species that constitute the Australian Campephagidae include both older endemic forms and recent colonizers. Typical members of the group, which range in size from that of a starling (e.g. the trillers (*Lalage*)) to almost the size of the domestic pigeon (e.g. the cuckoo-shrikes (*Coracina*)), exploit a fairly specific food source—the larger insects (cicadas, crickets, caterpillars) of the branches and foliage. Associated, however, with the occupation of the drier, more open, inland country is the trend towards ground feeding, reaching a climax in the semi-cursorial *Pteropodocys maxima*, almost all of whose food is obtained in this way. Several cuckoo-shrikes and trillers supplement their diet with berries and fruit.

Included in the Campephagidae are sedentary, nomadic, and migratory species and, as has become apparent during the course of the present work, species with both sedentary and migratory races.

* Australian Museum, Sydney.

II. Materials and Methods

The taxonomic section of this work was carried out on the bird collections of the American Museum of Natural History, New York (which includes the Mathews types), and the Australian Museum, Sydney.

Standard taxonomic methods have been followed in the study of geographic variation. Methods of measurement of appendages are described in Table 1. Unless there is reason for doing otherwise, comparative measurements are given for adult

Table 1

SIZE VARIATION IN ADULT MALES OF CORACINA NOVAEHOLLANDIAE

In this and subsequent tables the bill has been measured from the base of terminal feathers to the tip, the wing from its angle to tip, straightened along a rule, the tail from between the base of the central-most feathers to the tip. Mean values are shown in parenthesis in this table and in subsequent tables also

Race	Locality	Sample Size	Bill Length (mm)	Wing Length (mm)	Tail Length (mm)
C. n. novaehollandiae	Tasmania	12	16·8–18·3 (17·4)	195–202 (199)	138–151 (142)
C. n. melanops	Melbourne	8	18·3–19·9 (18·9)	202–214 (206)	140–153 (145)
	Sydney	12	19·2–20·5 (19·8)	198–210 (202)	138–151 (143)
	Brisbane and Warwick, Qld.	6	20·0–20·5 (20·2)	197–207 (201)	141–151 (143)
	Adelaide	5	17·8–19·3 (18·5)	200–210 (205)	140–151 (144)
	Cent. Aust.	5	19·3–21·1 (20·5)	199–212 (204)	140–152 (144)
	Broome Hill and Vasse, W.A.	10	16·8–18·9 (18·0)	198–212 (206)	140–152 (143)
C. n. subpallida	Hammersley region, W.A.	5	19·3–21·3 (20·2)	190–200 (196)	136–145 (141)
C. n. didima	Wide Bay, Cairns, Qld.	8	20·9–22·0 (21·3)	191–203 (197)	136–142 (140)
	Normanton, Qld.	6	20·9–21·7 (21·3)	189–196 (193)	135–144 (140)
	King R., N.T.	4	20·8–21·6 (21·2)	194–202 (198)	134–143 (139)
	Alexandria, N.T.	4	20·7–21·3 (20·9)	188–200 (195)	135–146 (139)
	Kimberleys, W.A.	8	20·7–22·1 (21·4)	194–200 (197)	135–144 (141)

males only. Males are usually larger than females in wing length in the Campephagidae, e.g. *Coracina novaehollandiae* from the Sydney area: males, 198–210 mm (mean of 12, 201 mm), females, 191–201 mm (mean of 9, 196 mm); *Lalage leucomela*, Cairns, males, 98–102 mm (mean of seven, 101 mm), females, 96–98 mm (mean of five, 97 mm).

Relevant aspects of the ecology of the different species have been obtained from the literature and in the field.

III. The Species and their Relationships

The Campephagidae extend from Africa and south-eastern Asia to Australia and Oceania. Several of the eastern genera have been reviewed taxonomically in

recent times. Ripley (1941) and Voous and Van Marle (1949) have discussed the evolution and distributional history of the species of *Coracina* in the islands to the north-west and north of Australia. Mayr and Ripley (1941) have investigated infraspecific variation in the Pacific forms of *Lalage*. More recently, Mayr (1955, also references therein) has discussed speciation in *Coracina*, *Lalage*, and *Edolisoma** in the Bismarck and Solomon Is. The only Australian forms reviewed taxonomically in recent times are the two species of *Lalage* (Mayr 1940).

The eight Australian campephagids have long been subdivided into four genera: *Pteropodocys* (ground cuckoo-shrike), one endemic species; *Coracina* (cuckoo-shrikes), four species, one endemic; *Edolisoma* (caterpillar-eater), one species; and *Lalage* (trillers), two species. *Edolisoma* has subsequently been reduced to a subgenus of *Coracina* by Delacour and Peters (unpublished data), a course supported by Mayr (1955) on the grounds that no satisfactory difference separates the two. However, Voous and Van Marle (1949) state ". . . we still consider the limits of the genus *Coracina* as opposed to *Edolisoma* sufficiently defined by the different shapes of the bill". Bill shape is a variable character in some campephagids (e.g. Australian forms of *novaehollandiae*, *tenuirostris*) so that it would appear to be of doubtful significance. *Edolisoma tenuirostris*, whilst a typical cuckoo-shrike, stands somewhat apart in having sexual dichromatism and a number of behavioural peculiarities, particularly the loud, ringing call note. Hence, the author considers its correct status is that of a subgenus.

The endemic *Pteropodocys*, an inhabitant of inland Australia, is a ventrally barred, long-tailed, predominantly grey species in which the bill is short and the sexes alike in colouring. It is without close relatives, though there is a long-tailed, short-billed *Coracina* (lacking ventral barring) in New Guinea.

Within the Australian *Coracina*, the species *C. lineata* (placed by Mathews in a separate genus *Paragraucalus*) stands somewhat apart, being steel-grey in colour, barred ventrally, and having a conspicuous yellow iris. It is a small, dainty form, and is restricted to the more luxuriant coastal forests of the east. It is obviously a fairly recent immigrant to Australia. *C. novaehollandiae*, the Australian populations of which are the end-members of a chain of forms extending from India through Indonesia, has secondarily colonized New Caledonia to give rise to a new species there, *C. caledonica* (Mayr 1945). *C. novaehollandiae* is large in size, pale grey in colour, and has a black head in the adult. There is a distinctive immature plumage in which the black is restricted to a mark through the eye. *C. novaehollandiae* is closely related to the smaller *C. robusta*, endemic to south-eastern Australia, and *C. papuensis* of New Guinea and northern Australia. The adults of these last two species are fairly similar, being uniform light grey throughout and with a blackish mark through the eye. *C. robusta*, however, has a distinctive immature plumage, the whole side of the head being black. Thus, it resembles the adult of *C. novaehollandiae* in colouring. The author agrees with Ripley (1941) that *C. papuensis* is an "advanced" counterpart of *C. robusta* that has lost its juvenile plumage. There could be a selective advantage in the immature *C. robusta* resembling the larger and more

*Pucheran's original spelling of this word, *Edolisoma*, should be followed. In the 1926 Checklist of the Royal Australian Ornithologists Union it is spelt "*Edoliisoma*".

aggressive *C. novaehollandiae*, with which it coexists throughout its range. This is doubtful, however. *Coracina*, like *Pteropodocys*, and in contrast with *Edolisoma* and *Lalage*, has no sexual dichromatism.

The Australian species of the genus *Lalage* are small and relatively dainty and they stand somewhat apart in general habits, calls, and in coloration. *L. sueurii* has a pied male and a brown female. In *L. leucomela* (Mathew's genus *Karua*) the dominant colour of the males is sooty-brown and the under-tail coverts are ochraceous in colour. The females are slightly more drab. *L. sueurii* occupies the drier, more open parts of the Australian continent and is markedly migratory and nomadic. *L. leucomela* keeps to the coastal rain-forests and mangrove swamps of the north and east. It is sedentary.

The Australian race of *L. sueurii* (*tricolor*) is unique in having a double moult and an eclipse plumage (Mayr 1940). The males have a brown "hen-like" plumage in winter. Whether or not the eclipse plumage is a "primitive" character that has been retained only in Australia, or has been secondarily acquired here, is uncertain. The loss of the conspicuous spring–summer plumage during that part of the year when the species is a nomad about the open savannahs and grasslands of northern Australia must, however, be of survival value.

IV. Taxonomy

(*a*) *Infraspecific Variation*

Pteropodocys maxima (Ruppell)
(ground cuckoo-shrike)

Ceblepyris maxima Ruppell, 1839, Mus. Senckenb. **3**: 28.

Distribution.—Interior of the Australian continent. Records from the east coast are exceptional; Barnard and Barnard (1925) noted its occurrence in the Rockhampton area during the 1902 drought. Skins in the Australian Museum labelled "Tweed River" and "Port Stephens" are probably wrongly labelled, though there is a sight record for Barrington, N.S.W. (Hyem 1937). There are breeding records from a variety of places in the interior of New South Wales and Queensland, northern South Australia, Macdonnell Ranges, Newcastle Waters, Barkly Tableland, N.T., and from the Kimberleys in the north-west and Broome Hill in the south-west of the continent, respectively.

Habitat.—Savannah grassland (mainly).

Geographic variation.—Geographic variation is virtually lacking. Some specimens from the hotter and drier areas (Alexandria, N.T., Mungi–Derby, W.A.) are slightly paler in colour than those from the south but the degree of difference is small (minor Gloger effect). Five adult male specimens from the north and four from the south-west of the continent fall within the range of six specimens from New South Wales in wing length (202–220 mm, mean 210 mm), tail length (180–195 mm, mean 186 mm), and bill length (16·5–17·4 mm, mean 16·9 mm).

P. maxima is not divisible into races.

Specimens seen.—NEW SOUTH WALES: Lachlan R. (5), Moree (4), Tweed R. (1), Port Stephens (2). SOUTH AUSTRALIA: Murray R. (4). WESTERN AUSTRALIA: Broome Hill (5), Salt R. (4), Mungi (2), Derby (4). NORTHERN TERRITORY: Alexandria (3), Macdonnell Ranges (4). (Numbers in parenthesis represent size of sample of adult birds.)

CORACINA NOVAEHOLLANDIAE (Gmelin)
(black-faced cuckoo-shrike)

Turdus novaehollandiae Gmelin, 1789, Syst. Nat. **1**: 814.

Distribution.—Throughout the continent. It has been recorded breeding in the more arid areas (Ayer's Rock, Mt. Olga, and Newcastle Waters, N.T.). Though a migrant to New Guinea, there is a breeding record for the Port Moresby area (Tubb 1945).

Habitat.—Sclerophyll forest and savannah woodland (mainly) to desert, where it frequents areas of eucalypts.

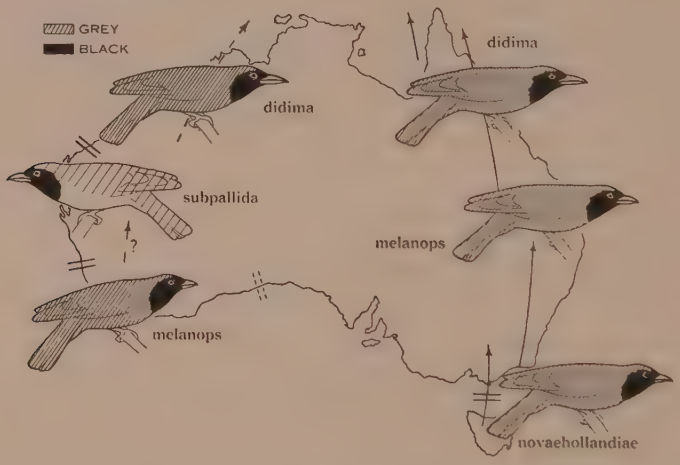

Fig. 1.—Distribution of races of *Coracina novaehollandiae* throughout the continent. The pronounced south–north cline of increasing bill length is also shown. Arrows indicate direction of migratory movements. Pairs of parallel lines indicate barriers which interrupt breeding continuity though some are crossed on migration.

Geographic variation.—As this is a migratory species, geographic comparison can only properly be made between series collected in spring and summer, i.e. in the breeding season. Measurements of adult males collected during this period from different parts of the continent are given in Table 1.

It will be seen that the bill increases in length from south to north, with an overall increment in the means of about 22 per cent. (see Fig. 1). The Tasmanian population (*n. novaehollandiae*) stands apart from the mainland series on both bill and wing measurements, and within the continent proper the bill length cline is much steeper in the south than in the north. The bills of southern and northern forms of *C. novaehollandiae* are compared with that of a typical *C. robusta* in Figure 2.

Wing lengths show a reverse cline to bill lengths, the differences between series from the south and north of the continent being much less (about 5 per cent.). The south-western population is as large as the south-eastern one, but has a small bill.

Thus variation in *C. novaehollandiae* can best be expressed by recognizing four races, as follows:

(1) *C. n. novaehollandiae* (Gmelin), 1789, Tasmania. This race is isolated and is characterized by a short bill and short wing.

(2) *C. n. melanops* (Latham), 1801, southern Australia. This represents the southern end of the wing length and bill length clines. The south-western population, apparently a partial isolate, can be included under *melanops* for the present.

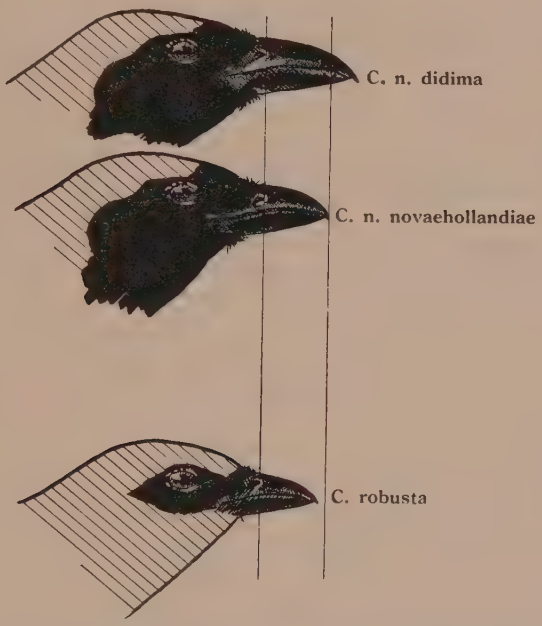

Fig. 2.—Heads of two forms of *Coracina novaehollandiae* and of *C. robusta* showing differences in adult colour pattern and bill size.

(3) *C. n. didima* Mathews, 1912, northern Australia. This form has a long bill and short wing, and represents the northern end of the clines in these characters.

(4) *C. n. subpallida* Mathews, 1912. Gascoyne R. to De Grey R., W.A. This isolated pallid form is very distinctive and is characterized by a very pale back and a white abdomen that merges imperceptibly into a light grey breast. The black areas, e.g. on the tail, also tend to be reduced, This race, of which specimens have been seen from the Strelley R., Maitland R., Nullagine, and Carnarvon, stands conspicuously apart from the other birds. There would appear to be some secondary interbreeding between it and the darker race (*didima*) to the north, for birds from Derby and Mungi are paler than the typical members of that race.

Migrant individuals.—Specimens collected in the various parts of the continent in autumn and winter were measured with the object of determining what portion of them were migrants (see also Section V). Only odd migrants were found, however, indicating that southern birds make up but a small proportion of the winter population in northern Australia. A male collected at Sydney during May had a bill 18·3 mm in length and that of a female labelled "April, North Queensland" measured 17·7 mm. Both of these fall within the range of breeding birds from Tasmania. Two males collected at Cape York in June had bills measuring 20·2 and 20·1 mm respectively and are presumably from New South Wales or southern Queensland. A small-billed bird (18·6 mm) collected on Melville I. in May could have come from the south-west of the continent, although its wing is rather small (192 mm) for that population.

The only bird from Lord Howe I. examined, a male collected in October, had a bill 21·4 mm in length and hence falls within the range of birds breeding in Queensland. The species does not breed on the island (Hindwood 1940).

Specimens seen.—TASMANIA: Various localities (18). SOUTH AUSTRALIA: Adelaide (9), Nullarbor Plain (3). WESTERN AUSTRALIA: Broome Hill and Vasse (16), King George Sound (3), Cranbrook (4), Strelley R. (2), Maitland R. (2), Nullagine (1), Carnarvon (4), Derby (4), Napier Broome Bay (3), Parry's Creek (3), Wyndham (2). NORTHERN TERRITORY: Melville I. (4), Ayer's Rock (2), Macdonnell Ranges (4), King R. (5), Port Keats (1), Alexandria (4). QUEENSLAND: Cape York (3), Normanton (9), Wide Bay and Cairns (13), Bowen (3), Lawn Hills (2), Brisbane and Warwick (10). NEW SOUTH WALES: Lord Howe I. (1), Moree (4), Coonamble (3), Dubbo (2), Sydney (20), Lachlan R. (4), Yanco (2). VICTORIA: Melbourne (14).

CORACINA ROBUSTA (Latham)
(little cuckoo-shrike)

Lanius robustus Latham, 1801, Index Orn. Suppl. p. 18.

Distribution.—Eastern section of the continent from the Adelaide area (Terrill and Rix 1950) to near Cairns, but extending well inland in places, e.g. Upper Barcoo R., near Blackall, Qld. (Alexander 1923), Moree, N.S.W. (Morse 1922), Hay, N.S.W., and Mildura, Vic. (N. Favaloro, personal communication).

Habitat.—Dry sclerophyll forest and savannah woodland.

Geographic variation.—The limited adult material available from northern Queensland indicates that the northern birds are paler on the undersurface than southern ones, as stated by North (1902). Some birds from intermediate regions are, however, quite pale, e.g. an unsexed bird from the Richmond R., Qld., a female from Jillaby, N.S.W., and another from Brisbane. There is a degree of individual variation in the ventral colouring, especially that of the throat.

The fact that northern *C. robusta* are pale and the Queensland species *C. papuensis* has a greyish breast raises the question of the identification of some of the adult birds from the area of overlap (Cairns–Cardwell). North states that *robusta* can always be distinguished by the blackness of the ear coverts. The author has not seen sufficient material to test this statement properly, but, in that the northern *robusta* has the feathers of the ear coverts *sooty at the base*, the distinction seems to hold. Size is not a criterion on which the two species can be distinguished, however,

as individuals of *papuensis* have wings measuring up to 157 mm, equal to the smaller members of *robusta*. As noted, *robusta* has a most distinctive immature plumage.

The number of specimens of *robusta* available is inadequate for a proper study of size variation. Measurements are given in Table 2. The evidence suggests that geographic variation in *robusta* is limited to minor colour differences but that there could be a south–north size cline. The author supports Mathews (1921) in not recognizing any races in the species.

Specimens seen.—QUEENSLAND: Cairns (2), Wide Bay (3), Duaringa (3), Brisbane (3). NEW SOUTH WALES: Richmond R. (4), Jillaby (1), Barrington (4), Dubbo (3), Sydney (3). VICTORIA: Sassafras (5).

TABLE 2

SIZE VARIATION IN ADULTS OF CORACINA ROBUSTA

Sex	Locality	Sample Size	Bill Length (mm)	Wing Length (mm)	Tail Length (mm)
Males	Dandenong Ranges, Vic.	2	15·7, 16·2 (16·0)	159, 173 (166)	125, 133 (129)
	Sydney and Barington	4	15·5–16·8 (16·0)	157–170 (162)	125–135 (130)
	Hay, N.S.W.	1	15·4	162	130
	Dubbo, N.S.W.	1	15·4	173	122
	Duaringa, Qld.	2	15·2, 16·3 (15·7)	158, 160 (159)	122, 125 (124)
	Wide Bay, N. Qld.	2	15·2, 16·0 (15·6)	150, 162 (156)	118, 127 (122)
Females	Sydney and Barrington	4	14·5–15·4 (15·0)	155–167 (161)	120–131 (126)
	Brisbane	1	14·9	154	115
	Wide Bay	2	14·8, 15·0 (14·9)	148, 149 (149)	115, 118 (117)

CORACINA PAPUENSIS (Gmelin)
(Papuan cuckoo-shrike)

Corvus papuensis Gmelin, 1788, Syst. Nat. **1**: 371.

Distribution.—Northern coastal strip of Australia from Inkerman in the east to the Fitzroy R. in the north-west. It occurs in some of the drier country to the west of the Gulf of Carpentaria (e.g. Borroloola, Lawn Hills Station).

The species has a wide range through New Guinea and the adjacent islands.

Habitat.—Tropical savannah woodland.

Geographic variation.—The Australian material falls into three forms, as follows:

(1) *C. p. hypoleucus* (Gould), 1848. North-western Australia and Northern Territory to the Gulf of Carpentaria (*vide* a specimen from Lawn Hills Station near Cloncurry). The breast is pure white.

The specimens from Melville Island have a faint greyish wash over the breast and the tibial feathering is slightly darker than other north-western birds. The bill would appear to be small. Further material may prove that this population merits a name.

The few Kimberley specimens have a relatively short wing. More material is needed from this area.

(2) *C. p. stalkeri* Mathews, 1912. North-eastern Queensland from Inkerman (?) to Cooktown. In this form there is a well-defined greyish wash over the breast and upper abdomen. The bill is short.

(3) *C. p. oriomo* Mayr & Rand, 1936. Cape York and southern New Guinea (region of Oriomo R. and Merauke (Mayr 1941)). This form is coloured like *p. stalkeri* but the bill is significantly longer (Table 3).

Measurements of adult males of *C. papuensis* are given in Table 3. Little geographic variation in overall size is indicated within Australia but, as noted, bill length is variable.

TABLE 3

SIZE VARIATION IN ADULT MALES OF CORACINA PAPUENSIS

Race	Locality	Sample Size	Bill Length (mm)	Wing Length (mm)	Tail Length (mm)
C. p. stalkeri	Cairns, Qld.	8	15·5–16·5 (16·0)	148–157 (152)	112–120 (116)
	Cooktown, Qld.	3	16·4–16·9 (16·6)	152–157 (155)	110–121 (115)
	Lawn Hills, Qld.	2	16·0, 17·0 (16·5)	154, 156 (155)	108, 120 (116)
C. p. hypoleucus	Melville I., N.T.	4	16·3–16·7 (16·6)	145–153 (150)	106–119 (116)
	Brocks Ck., Eureka, and Port Keats, N.T.	8	16·5–18·4 (17·5)	147–158 (154)	107–120 (114)
	Parry's Ck., W.A.	4	16·7–18·4 (17·5)	147–152 (148)	107–119 (112)
C. p. oriomo	Cape York	5	17·4–18·9 (17·9)	141–154 (150)	107–118 (112)
	Lake Daviumbu, New Guinea	4	17·6–18·7 (18·1)	143–149 (146)	105–115 (110)

It is possible that the north-western and north-eastern populations of *C. papuensis* represent separate invasions of the continuent from the north, for they are readily separable on colour. At any event, the similarity in bill length of Cape York and southern New Guinea stocks, as compared to those from further south, indicates that the north-eastern corner of the continent is still being colonized from the north. The Melville I. population is possibly a partial isolate.

Specimens seen.—QUEENSLAND: Cairns (15), Cooktown (3), Cape York (8), Lawn Hills Station (3). NORTHERN TERRITORY: Brock's Creek, Eureka, Port Keats (16), Melville I. (7). WESTERN AUSTRALIA: Parry's Creek (6), Wyndham (4).

CORACINA LINEATA (Swainson)
(barred cuckoo-shrike)

Ceblepyris lineatus Swainson, 1825, Zool. J. **1**: 466.

Distribution.—Eastern coastal strip of Australia from Cape York to about Dorrigo, N.S.W. Specimens in the Australian Museum collection labelled "Lithgow"

are possibly wrongly labelled, though the species is recorded from Sydney (Chisholm 1932). The species has a wide range through New Guinea and the adjacent islands.

Habitat.—Rain-forest and wet sclerophyll forest.

Geographic variation.—The Australian birds, constituting the nominate race, (*C. l. lineata*) are distinct from those of New Guinea to the north (Mayr 1941). Within Australia, specimens from New South Wales and Cairns–Cooktown are indistinguishable so far as colour and colour pattern are concerned. Measurements of adult males are given in Table 4. No geographic size variation is indicated by the limited material of *C. lineata* available from Australia.

Specimens seen.—QUEENSLAND: Cooktown (2), Cairns, Cardwell (12) Wide Bay (3), Brisbane (3), Darling Downs (1), Macpherson Ranges (2). NEW SOUTH WALES: Tweed R. (4), Richmond R. (4), Dorrigo (3), Lithgow (2).

TABLE 4

SIZE VARIATION IN ADULT MALES OF CORACINA LINEATA

Locality	Sample Size	Bill Length (mm)	Wing Length (mm)	Tail Length (mm)
New South Wales	6	13·8–14·5 (14·2)	146–152 (149)	97–105 (99)
Brisbane	1	14·4	149	97
Darling Downs, Qld.	1	14·5	142	97
Cairns, Cardwell, Qld.	8	13·9–14·7 (14·4)	144–153 (148)	98–107 (101)

CORACINA (EDOLISOMA) TENUIROSTRIS (Jardine) (cicadabird)

Graucalus tenuirostris Jardine, 1831, Edin. J. Nat. Geog. **3**: 211.

Distribution.—Eastern coastal strip of Australia from the Dandenong Ranges, Vic., to Cape York, thence westwards along the north coast to Melville I. and the Fitzroy R. The species ranges widely through New Guinea and the adjacent islands.

Habitat.—Tall coastal and mountain sclerophyll forests in eastern Australia. In the Northern Territory the habitat is described as mangroves, scrub, and forest (see Mathews 1921, p. 141).

Geographic variation.—There is a limited amount of geographic colour variation in males collected during spring and summer, but none in females, notwithstanding the remarks of Mathews (1921).

Measurements of adult males of *C.* (*E.*) *tenuirostris* are given in Table 5. These indicate a south–north cline of decreasing size both in the eastern and western sections of the continent. Bill length is individually variable. Birds from the north-west of the continent have conspicuously smaller bills than those from the east.

The variation in *C.* (*E.*) *tenuirostris* indicates the occurrence of three races as follows:

(1) *C. (E.) t. tenuirostris* (Jardine), 1831. Victoria to central Queensland.

(2) *C. (E.) t. obscura* Mathews, 1912. Cairns to Cape York. In this form the black on the sides of the face of the males is more intense and extensive. The overall size is small, this being the northern end of the size cline.

(3) *C. (E.) t. melvillensis* Mathews, 1912. Kimberleys and Northern Territory. In this form the male is coloured like *obscura*, the overall size is small, and the bill is short. It is probably isolated by the dry country at the head of the Gulf of Carpentaria.

Specimens seen.—VICTORIA: Melbourne (11). NEW SOUTH WALES: Sydney (9), Richmond R. (4). QUEENSLAND: Cairns (8), Cape York (7). NORTHERN TERRITORY: Melville I. (7), Port Essington (3), King R. (4). WESTERN AUSTRALIA: Fitzroy R. (6), Napier Broome Bay (4).

TABLE 5

SIZE VARIATION IN ADULT MALES OF CORACINA (EDOLISOMA) TENUIROSTRIS

Race	Locality	Sample Size	Bill Length (mm)	Wing Length (mm)	Tail Length (mm)
C. (E.) t. tenuirostris	Melbourne	5	17·0–18·5 (17·8)	137–140 (138)	98–106 (100)
	Sydney	7	16·8–18·0 (17·7)	132–137 (136)	97–104 (99)
	Richmond R., N.S.W.	2	17·4, 17·4 (17·4)	132, 140 (136)	100, 101 (101)
C.(E.) t. obscura	Cairns, Qld.	5	16·8–18·2 (17·8)	130–133 (132)	93–103 (98)
	Cape York	4	17·5–18·5 (18·0)	123–127 (125)	92–97 (95)
C.(E.) t. melvillensis	Melville I., N.T.	4	16·5–17·5 (17·0)	123–127 (125)	92–100 (96)
	Port Essington, N.T.	1	15·8	126	94
	King R., N.T.	1	15·8	129	95
	Fitzroy R., W.A.	4	14·8–16·0 (15·3)	125–136 (130)	92–102 (98)
	Napier Broome Bay, W.A.	1	15·6	128	99

LALAGE SUEURII TRICOLOR (Swainson)
(pied triller)

Ceblepyris tricolor Swainson, 1825, Zool. J. **1**: 467.

Distribution.—Throughout Australia. Small numbers migrate to New Guinea.

Habitat.—Savannah woodland and grassland (mainly).

Geographic variation.—The author is in agreement with Mayr (1940) that there is no geographic variation in *Lalage sueurii* within Australia. Mayr demonstrated that the Australian race, *tricolor* (Swainson), 1825, is slightly larger than the race inhabiting the lesser Sunda Is.

Wing length measurements for 18 males from Australia range from 98 to 104 mm (mean 101 mm), tail measurements from 68–75 mm (mean 72 mm), and bill measurements from 10·8–11·4 mm (mean 11·2 mm). Wing length measurements for 16 females range from 96–102 mm (mean 100 mm).

Specimens seen.—QUEENSLAND: Port Denison (5), Brisbane (7). NEW SOUTH WALES: Sydney (9), Woy Woy (3), Moree (8), Lithgow (3), Bourke (8), Lachlan R. (4). VICTORIA: Melbourne (8). SOUTH AUSTRALIA: Port Augusta (8). NORTHERN TERRITORY: Alice Springs (9). WESTERN AUSTRALIA: Forrest R. (5), Derby (6), King George Sound (7), Broome Hill (4).

Lalage leucomela (Vigors & Horsfield)
(varied triller)

Campephaga leucomela Vigors and Horsfield, 1826, Trans. Linn. Soc. Lond. **15**: 215.

Distribution.—From about Port Keats in the north-west of the continent to Melville I. and, in the east, the coastal strip from Cape York to the Bellingen R., N.S.W.

There is an extensive gap in the range in the region of the dry Gulf of Carpentaria and the author agrees with Mayr (1940) that in the east the species may be broken up into several isolates.

Habitat.—Mangroves (mainly) and strips of monsoon forest along rivers (Northern Territory); rain-forest and wet sclerophyll forest in eastern Australia.

Table 6

SIZE VARIATION IN ADULT MALES OF LALAGE LEUCOMELA

Race	Locality	Sample Size	Bill Length (mm)	Wing Length (mm)	Tail Length (mm)
L. l. leucomela	Bellingen and Tweed Rs., N.S.W.	7	10·8–11·6 (11·3)	99–106 (101)	85–90 (87)
	Brisbane	1	11·6	101	88
	Burnett R., Qld.	1	11·5	103	87
	Cairns, Qld.	5	10·9–11·8 (11·4)	98–102 (101)	82–85 (83)
L. l. yorki	Cape York	5	10·8–11·6 (11·2)	95–101 (98)	76–84 (81)
L. l. rufiventer	Melville I., N.T.	5	10·7–11·5 (11·1)	97–101 (99)	78–83 (81)

Geographic variation.—Mayr (1940) has reviewed this species and has listed three races, as follows:

(1) *L. l. leucomela* (Vigors & Horsfield), 1826. Eastern Australia from northern New South Wales (Bellingen R.) to Cooktown.

(2) *L. l. yorki* Mathews, 1912. Cape York Peninsula. Males differ from the nominate race mainly in the throat, breast, belly, and flanks being almost pure white, instead of greyish and faintly barred. It is also slightly smaller in size.

(3) *L. l. rufiventer* (Gray), 1846. Daly R. to Alligator R., N.T. In the males of this form the throat, breast, and flanks are barred, and the entire undersurface has a slight buffy wash. This race, as has been pointed out by Mayr (1940), represents a separate invasion of the continent from the north-west.

Measurements of adult males, which reflect those of Mayr (1940), are given in Table 6.

Specimens seen.—NEW SOUTH WALES: Tweed R. (6), Richmond R. (5), Bellingen R. (6). QUEENSLAND: Brisbane (6), Stradbroke I. (4), Burnett R. (4), Cairns (7), Cardwell (2), Cape York (8), Torres Strait (3). NORTHERN TERRITORY: Melville I. (8), Port Keats (3), Daly R. (3).

(*b*) *Nomenclature and New Synonymy*

Pteropodocys maxima (Ruppell), 1839. Synonym: *pallida*.

Coracina novaehollandiae novaehollandiae (Gmelin), 1789.
Coracina novaehollandiae melanops (Latham), 1801.
Coracina novaehollandiae subpallida Mathews, 1912.
Coracina novaehollandiae didima Mathews, 1912.

Coracina robusta (Latham), 1801.

Coracina papuensis hypoleucus (Gould), 1848.
Coracina papuensis stalkeri Mathews, 1912.
Coracina papuensis oriomo Mayr & Rand, 1936.

Coracina lineata lineata (Swainson), 1825.

Coracina (*Edolisoma*) *tenuirostris tenuirostris* (Jardine), 1831.
Coracina (*Edolisoma*) *tenuirostris obscura* Mathews, 1912.
Coracina (*Edolisoma*) *tenuirostris melvillensis* Mathews, 1912.

Lalage sueurii tricolor (Swainson), 1825.

Lalage leucomela leucomela (Vigors & Horsfield), 1826.
Lalage leucomela yorki Mathews, 1912.
Lalage leucomela rufiventer (Gray), 1846.

V. Ecology and Geographic Variation

(*a*) *Seasonal Movements of the Species Compared*

(i) *Pteropodocys maxima*.—This is a nomadic species, and its distribution varies from year to year and season to season (see Serventy and Whittell (1951) for notes on its distribution in south-western Australia, Robinson (1939) for the Gascoyne R., north-western Australia, and Thomas (1944) for the Victorian Mallee). It may remain for long periods in an area, however, whilst conditions remain good, e.g. in parts of western New South Wales (Cox and Hamilton 1889). In the far north of the range (Gulf of Carpentaria) individuals remain all year but there are fewer in winter (see Mathews 1921, p. 151).

(ii) *Coracina novaehollandiae*.—South–north migration is pronounced in the populations of Tasmania (race *novaehollandiae*), and southern Victoria (some *melanops*) but is less developed further north. In winter there is a wide dispersal of the species through New Guinea (members of the races *novaehollandiae*, *melanops*, and *didima* being represented (Mayr 1941)), and Timor, Amboina, and New Britain (White 1938).

Within Australia, there are various records of migrating flocks. These are mostly from either the far south or far north of the continent: Tasmania (Dove 1939), southern Victoria (see Mathews 1921, p. 116; Howe 1928; Brown and Ramsay 1950), and Cape York (see Mathews 1921, p. 120). A feature of these migratory populations is that, even in the far south, many individuals remain behind to winter in the breeding grounds (Sharland 1945; Wheeler 1946). Other districts, however, are deserted in winter (Howe 1928; Dove 1938; Brown and Ramsay 1950).

Areas of the Australian continent from which there is evidence of a distinct south–north migration are indicated in Figure 1.

Nomadism, often of an essentially local nature, apparently characterizes the populations of *C. novaehollandiae* inhabiting South Australia (see Mathews 1921, p. 115; McGilp 1923), the Victorian Mallee (Thomas 1944), and central Australia. In south-western Australia it is regarded as a resident bird (Whitlock 1937; Sedgwick 1940; Serventy 1948). The dark south-western *melanops* is recorded as occurring in the Gascoyne R. habitat of the pale *subpallida* (Robinson 1939), however, and Whitlock (1910) refers to it leaving the East Murchison district before winter and returning again in September. These records suggest that a limited northward movement may, in fact, take place from the south-west corner.

In eastern New South Wales the nature of the movements of *C. novaehollandiae* are difficult to define but give the appearance of nomadism. There is little visible evidence of any distinct south–north movement. Some areas are virtually deserted in winter, e.g. Canberra (Lamm and Calaby 1950) and Wellington (Althofer 1934), but in the Sydney area numerous individuals and small flocks of up to 10 may be seen moving about with no set direction at this time (K. A. Hindwood, personal communication). In the Murphy's Creek area of southern Queensland the autumn movements are recorded as having a westward trend (Lord 1956). At intervals members of the species wander eastwards to Lord Howe I. and New Zealand, 400 and 1200 miles to the east respectively (Hindwood 1940; Falla 1953).

The northern coastal populations of *C. novaehollandiae* give the appearance of being either sedentary or undertaking movements of a local nature (Rhodes 1944; Hopkins 1948, 1949; *et al.*). As noted, however, members of the race *didima* do extend to the northern island groups in winter. The distinctive north-western race *subpallida*, since it has not been taken elsewhere, is certainly sedentary.

Thus, the seasonal movements of *C. novaehollandiae* are most complicated. It may be a south–north migrant, a nomad, or a sedentary form, depending on the part of the continent inhabited. It is significant that, despite this, there is a considerable geographic colour and size variation in the species.

(iii) *Coracina robusta*.—Precise information on the movements of this species is difficult to obtain. It is certainly nomadic over parts of the range, e.g. Peel I., Moreton Bay (Agnew 1921), Cobbora, N.S.W. (see Mathews 1921, p. 102), and in the drier interior. However, individuals are to be seen about Sydney throughout the year (W. Lane, personal communication).

(iv) *Coracina papuensis*.—This is essentially a sedentary species: see field notes of McLennan (in MacGillivray 1918, p. 200) for Cape York, and of Rhodes (1944) for the Adelaide R. section of the Northern Territory.

(v) *Coracina lineata*.—This species is nomadic over most of its Australian range: cf. records for Rockingham Bay, north Qld. (Campbell and Barnard 1917), Dunk I. (Austin 1950), Brisbane area (Agnew 1921), Tenterfield, N.S.W. (M. Goddard, personal communication).

(vi) *Coracina* (*E.*) *tenuirostris*.—This is a south–north migrant throughout its range. There is a large wintering population in New Guinea. The species is only present in Victoria and New South Wales from October to January. The breeding

range is deserted at least as far north as central Queensland in winter (see Mathews 1921, p. 141). It also vacates the Kimberleys at this time (see Mathews 1921, p. 142).

(vii) *Lalage sueurii*.—The seasonal movements of this species, basically an inhabitant of the drier savannah regions, can best be described as a combination of migration and nomadism, but with all individuals taking part in the movements.

L. sueurii vacates the whole southernmost third of the continent in autumn and winter. In the Sydney area it arrives in September and departs in February (North 1902). This accords fairly well with its occurrence in coastal South Australia (Terrill and Rix 1950) and in the south-west of the continent (Serventy and Whittell 1951). Vacation of the breeding grounds extends at least as far north as Newcastle Waters in central Australia (Jarman 1944), the birds being only present from December to March, when they breed. Some birds, however, winter as far south as Moree in the east of the continent (Morse 1922) and the East Murchison district in the west (Serventy and Whittell 1951).

The large wintering population of *L. sueurii* extends across the north of the continent, where it is superimposed upon a small local one. Winter concentrations are recorded from parts of the Hammersley area and Kimberleys, Port Essington, Roper R., McArthur R., Mornington I., Upper Flinders R., Cape York, and on the Kirrama Tableland near Cairns. Some individuals reach New Guinea (Mayr 1941). In north-western Australia the winter distribution is "patchy", irregular, and dependent on seasonal conditions (see North 1902, p. 120; also Mathews 1921, p. 150). Breeding may take place as early as July–August in the Pt. Cloates–Gascoyne R. section (see Mathews 1921, p. 150).

Of considerable significance in restricting the development of geographic size and colour variation is the fact that the areas of spring-breeding concentration vary from year to year, occurring where conditions happen to be fertile: note remarks of McGilp (1923) with respect to the Lake Frome area of South Australia, Whitlock (1937) for south-western Australia, Robinson (1939) for the Hammersley area of north-western Australia, and Gilbert (1935) for the Sydney area.

The seasonal behaviour of *L. sueurii* in Australia closely resembles that of *Epthianura tricolor* (Keast 1958).

(viii) *Lalage leucomela*.—This is a sedentary species throughout its range: *vide* remarks of McLennan (in MacGillivray 1918, p. 200) with respect to Cape York, Agnew (1921) in south Queensland, and many others.

The seasonal movements of the various Australian campephagids are summarized in Table 7. They fall into three general categories: true south–north migrants, nomads, and sedentary species. One species comes into the first category, two are sedentary, and four can be classed as nomads. It is in the migrants and sedentary species, not the nomadic ones, that geographic variation occurs.

Lalage sueurii (no geographic variation) and *Coracina novaehollandiae* (marked variation) provide an interesting comparison for both species undertake extensive seasonal movements. In the former, primarily an inhabitant of the interior, seasonal movements and breeding behaviour are apparently such as to lead to an accelerated intermixture of individuals from different areas. Even in migratory populations of

C. novaehollandiae, however, not all individuals undertake seasonal movements. Variation of the extent described certainly could develop only if the migratory individuals return to the areas of their origin to breed. In that the species is basically a forest dweller and the bulk of its members inhabit the more fertile coastal areas this presumably is possible.

TABLE 7

COMPARISON OF THE TYPE OF DISTRIBUTION, SEASONAL MOVEMENTS, AND GEOGRAPHIC VARIATION IN AUSTRALIAN CAMPEPHAGIDAE

Species	Type of Distribution	Seasonal Movements	Geographic Variation and Isolation
Pteropodocys maxima	Range extensive, broad, and long; continuous. Inland species	Nomadic, breeding where propitious	Variation negligible
Coracina novaehollandiae	Range extensive, broad, and long. Some isolation. Inland and coastal species	South–north migration in south-east (mainly). Nomadic in places, elsewhere sedentary	Marked variation, isolates, and clines
C. robusta	Range fairly extensive, longer than broad, continuous. Inland and coastal species	Somewhat nomadic	Variation minor
C. papuensis	Range long but narrow. Areas of thinning and some isolation. Coastal species	Sedentary	Variation moderate. Three distinct forms, some isolation
C. lineata	Distribution continuous. Coastal species	Nomadic and somewhat migratory	No variation
C. (E.) tenuirostris	Range long but narrow. Eastern and north-western populations isolated. Coastal species	South–north migrant	Variation moderate. Northern and eastern forms probably developed in isolation
Lalage sueurii	Range extensive, broad, and long; continuous. Inland species (mainly)	Nomadic and migratory, breeding in spring wherever conditions propitious	No variation
L. leucomela	Range long but narrow, discontinuous. Coastal species	Sedentary	Marked variation. Three isolates

It is well known in the northern hemisphere, where banding has been carried on for a considerable time, that individuals of migratory species commonly home to specific nest sites and localities from year to year (Thomson 1926). As yet no banding

work has been carried out on *C. novaehollandiae*. There is, however, circumstantial evidence to support homing tendencies, e.g. a pair of birds nested in the same fork in a tree at Chatswood, N.S.W., from 1945 to 1951 (K. A. Hindwood, personal communication), and another in a fork at Arncliffe, N.S.W., from 1954 to 1956 (A. R. McGill, personal communication). It is a reasonable assumption that in these cases the same pair, or their progeny, was involved.

It would appear from the above comparison that for geographic variation in a species to be understood the precise nature of the seasonal movements must be understood.

(*b*) *Distribution and Habitat*

Of the eight members of the family in Australia four have ranges that are broad as well as long, and four have ranges that are peripheral. In the former, which inhabit the drier savannah areas, gene flow is likely to be multidirectional. In species specialized for life in sclerophyll forest, rain-forest, and mangroves the range is necessarily peripheral and not only do these habitats tend to be discontinuous but gene flow can only occur between south and north, or east and west.

Distribution type is compared with seasonal movements and geographic variation in Table 7. With the exception of the somewhat confusing case of *C. novaehollandiae* it will be noted that variation tends to be greatest in species with essentially a peripheral range (*Coracina papuensis*, *C.* (*E.*) *tenuirostris*, and *Lalage leucomela*), negligible in those with broad interior ranges.

(*c*) *Isolation and Distributional Barriers*

The following two distributional barriers are indicated in the case of the Australian Campephagidae:

(1) Areas of sea, e.g. Bass Strait (*C. novaehollandiae*) and Torres Strait (*C. lineata*, *L. leucomela*). Beyond Australia the nearest relative of *L. sueurii* occurs on the Lesser Sunda Islands. There is a derivative of *C. novaehollandiae* on New Caledonia.

(2) Tracts of arid country that extend from inland to coast to break up forest associations, e.g. at the head of the Gulf of Carpentaria (*L. leucomela*), Shark Bay and Ninety Mile Beach in the west (*C. novaehollandiae*). These dry sections are also distributional barriers to species in other families (Keast 1956).

Differences between the Cape York and Cairns populations of *Coracina papuensis* and *Lalage leucomela* are due to the former apparently representing a later wave of colonization from the north which has been contained, apparently, by the 150-mile wide tract of dry savannah country between Princess Charlotte Bay and Cooktown. This barrier has also been of significance in the development of geographic forms and isolates in mammals (Tate 1952).

(*d*) *Isolation under Continental and Archipelago Conditions Compared*

Isolates that have differentiated to such an extent that speciation appears to be well advanced are few in the Australian Campephagidae.

The total number of morphologically differentiated isolates occurring on the Australian continent (including Tasmania but excluding New Guinea) would appear to be 7 and perhaps as high as 10 (Table 8). These occur in *C. novaehollandiae* (2 or 3), *C. papuensis* (2, possibly 3), *C.* (*E.*) *tenuirostris* (probably 1), and *Lalage leucomela* (2–3). Several of these, however, are distinguished only on minor characters.

TABLE 8

COMPARISON OF THE NUMBER OF MORPHOLOGICALLY DIFFERENTIATED ISOLATES IN THE AUSTRALIAN CAMPEPHAGIDAE ON THE CONTINENT AND ARCHIPELAGO

The archipelago area embraces New Guinea, the Bismarck and Solomon Is., and covers approximately the same area as the Australian continent. Estimates of number of morphologically differentiated isolates have been made from the works of Mayr (1941, 1945, 1955), and Mayr and Ripley (1941)

Species	Isolates in Australia	Isolates in an Equivalent Archipelago Area
Pteropodocys maxima	Nil	Does not occur
Coracina novaehollandiae	2, possibly 3	Nil (occurs only as migrant)
C. robusta	Nil	Does not occur
C. papuensis	2, possibly 3	7
C. lineata	Nil	8
C. (*E.*) *tenuirostris*	Probably 1	17
Lalage sueurii	Nil	Nil (occurs only as migrant)
L. leucomela	2, possibly 3	3
Total	7, possibly 10	35

Four of the eight Australian campephagids have a wide range through the island archipelagos to the north of Australia. In Table 8, the estimated number of morphologically differentiated isolates for an archipelago area of approximately the same size as the continent are compared with those on the continent. Four to five times as many are indicated (about 35).

The conclusion is inescapable that the archipelago is a much more favourable area for the production of isolates than the Australian continent. This is probably because the more luxuriant tropical islands provide a constant supply of food all the year round and hence favour the development of a sedentary way of life. Once this is attained a relatively small water barrier may be quite effective in interrupting gene flow. Viewed in another way, however, it would probably not be too much of an exaggeration to look upon the bulk of these island forms (many of which are quite distinctive) as over-specialized and with little prospect for survival should the environmental conditions change. It is the continental populations that are the all-important genetic reservoir of the species and where the important adaptations that will ensure its continuance are likely to occur.

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A REVISION OF THE PINK BOLLWORMS OF COTTON (*PECTINOPHORA* BUSCK (LEPIDOPTERA: GELECHIIDAE)) AND RELATED GENERA IN AUSTRALIA

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Summary

The Australian representatives of four genera of Gelechiidae, the larvae of which apparently all feed within the seed capsules of cotton and other Malvaceae, are reviewed.

Pectinophora Busck (pink bollworms).—Three species are recognized, *P. gossypiella* (Saunders), *P. scutigera* (Holdaway), and *P. endema*, sp. nov., from eastern Australia. Holdaway's conclusions about the distribution of the first two are largely confirmed. As there have been no authentic records of *P. gossypiella* from Queensland, the existing quarantine restrictions on the importation of untreated cotton to that State are fully justified.

Pexicopia, gen. nov.—The genus is erected for a group of 16 Australian species, together with *Tinea malvella* Hübner from Europe, *Mometa chlidanopa* Meyrick from Africa, and *Gelechia melitolichna* Meyrick from China. Nine of the Australian species are described as new, while the remaining seven have been transferred from *Gelechia*.

Metacaena, gen. nov.—The genus is based on a new species, *M. adela*, from Queensland, superficially similar to *Pectinophora* and *Pexicopia*.

Decatopseustis Meyrick.—A new species, *D. cataphanes*, from the Australian Capital Territory, is described.

Genitalic and other characters for the separation of these genera from one another and from the allied genera *Platyedra* Meyrick, *Mometa* Durrant, *Anisoplaca* Meyrick, *Phrixocrita* Meyrick, and *Trachyedra* Meyrick are discussed. The genitalia of both sexes and the wings of Australian species are figured, and keys to the species are provided.

Introduction

The lack of uniformity in the nomenclature of the pink bollworms attacking cotton in various parts of the world merely illustrates our inadequate knowledge of the taxonomy of the group. In the United States, the pink bollworm has been accepted as *Pectinophora gossypiella* (Saunders), the generic assignment dating from 1917 when Busck described the genus *Pectinophora* with *gossypiella* as type species. In other cotton-growing countries, the pink bollworm is more generally known as *Platyedra gossypiella*. Holdaway's (1926) description of the superficially similar *P. scutigera* from Queensland, where he claimed *P. gossypiella* did not occur, posed problems of identity and distribution of special significance to the Australian quarantine authorities.

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Meyrick (1895) erected the genus *Platyedra* for the single European species *Gelechia vilella* Zeller. Although in 1905 he stated that *Depressaria gossypiella* Saunders was correctly referred to the genus *Gelechia* Hübner, later (Meyrick 1918) he included *gossypiella* and *Tinea malvella* Hübner with *vilella* in *Platyedra*. He considered that their common larval habit of feeding in the seed capsules of Malvaceae supported this conclusion. In erecting the genus *Pectinophora*, Busck (1917) recognized that *gossypiella* and *malvella* were generically distinct from *Gelechia* but, apparently owing to Meyrick's inadequate description, failed to consider the suitability of *Platyedra* for these species (Busck 1919). In his revision of the Gelechiidae, Meyrick (1925) treated *Pectinophora* as a synonym of *Platyedra*, a position which he steadfastly maintained despite the differences in genitalic structure to which Busck drew his attention in correspondence (Gates Clarke 1955, p. 13). Hence the combination *Platyedra gossypiella* has persisted in the economic literature of the Old World.

Apart from these three controversial species, several from Africa have also been added to the genus *Platyedra* by Meyrick. Durrant (1914) described the monotypic genus *Mometa*, based on a new species reared from cotton in southern Nigeria, and Meyrick (1925) recognized this genus as distinct from *Platyedra*, adding a new species in 1927, *M. chlidanopa*, from Uganda. The critical evaluation of these genera and species by the use of such characters as the genitalia has long required attention.

Turner (1919) first reported *gossypiella* from Australia and followed Meyrick by referring it to *Platyedra*. His record was based on specimens collected by G. F. Hill in the Northern Territory, at least one of which was submitted to Meyrick for determination (Tryon 1924), and on specimens he himself had taken at Brisbane. Meyrick (1922) recorded specimens from Broome, W.A., taken by Mjöberg in 1911. Tryon (1924) reported that *Platyedra* larvae were plentiful in the seed capsules of several native species of *Hibiscus* in southern Queensland, but up to that time he had not found them attacking cultivated cotton. Because of larval differences, however, he expressed doubt that they were *P. gossypiella*. The same year, 1924, pink bollworms were reported attacking cotton in Queensland for the first time (Holdaway 1926) and Ballard (1925) stated that the species was *P. gossypiella*. Subsequently, Holdaway (1926) confirmed that the larvae of the pink bollworm from cotton in Queensland were distinct morphologically from those of *P. gossypiella*, and proposed the name *Platyedra scutigera* for the Queensland species. He also stated, on the basis of larval characters, that *gossypiella* occurred in the Northern Territory and north-western Australia, but not in Queensland. Again on larval characters, he asserted that two other species occurred in the seed capsules of native *Hibiscus* and *Abutilon* in Queensland. Later Holdaway (1929*b*) was able to separate the adults of *gossypiella* and *scutigera* by characters of the genitalia in both sexes. He then followed Busck (1917) in referring the two species to the genus *Pectinophora*.

The present study confirms Holdaway's conclusions that the Queensland pink bollworms are distinct from *gossypiella* and shows that three allied genera also occur in Australia. The genitalia provide reliable characters for distinguishing these genera from one another and from related exotic genera including *Platyedra* and *Mometa*. The larvae of all the species in these related genera probably feed in the

seed capsules of various species of Malvaceae and, with careful rearing both in Africa and Australia, further species will no doubt be discovered.

In this paper the genus *Pectinophora* is reviewed and a new species is described from Queensland. A new genus, *Pexicopia*, is erected to include *Tinea malvella* from Europe, *Mometa chlidanopa* from Uganda, and *Gelechia melitolicna* Meyr. from China, together with 16 Australian species, seven of which were previously described in the genus *Gelechia*. A second new genus, *Metacaena*, is described from Queensland, based on a new species which is superficially similar to species of *Pectinophora* or certain species of *Pexicopia*. *Decatopseustis* Meyr., which is also closely related, is reviewed and a new species described from the Australian Capital Territory.

Related Genera not Represented in Australia

Several genera, clearly related to *Pectinophora*, but which do not occur in Australia, have not been reviewed in this paper. However, the following information may assist those who need to distinguish these genera or to assign species not included here.

In *Platyedra*, with type species *Gelechia vilella*, the gnathos of the male genitalia is in the form of a strong hook, similar to that found in many other genera of the Gelechiidae. The uncus is broad and rounded, not tapering, and the costa of the valva is separate, in the form of a large hook with 4 or 5 spines near its tip. The signa of the female genitalia are a pair of plain sclerotized ridges. *Mometa*, with type species *M. zemiodes*, also has a hook-like gnathos, but it is only slightly curved. The uncus is strongly spatulate, though not lobed as in *Pexicopia*, while the valva is simple with a row of large, probably deciduous spines on the margin near the apex. The apical segment of the labial palpi, clothed with long, slender, slightly spreading scales anteriorly in both sexes, also distinguishes *Mometa* from other genera in the group. The female bursa copulatrix lacks signa.

In *Anisoplaca* Meyr., with type species *A. ptyoptera* Meyr. from New Zealand, the uncus is dilated or spatulate (as also in *A. cosmia* Bradley from Norfolk I.), and the gnathos is a very strong sickle-shaped hook (Philpott 1927). Although Meyrick (1925) stated that there was no antennal pecten in this genus, the author has observed one hair scale on the scape in the New Zealand species *A. achyrota* Meyr., and Bradley (1956) states that there is a well-developed pecten of several hair-like scales in *A. cosmia*.

The male genitalia in *Phrixocrita* Meyr., with type species *P. aegidopsis* Meyr. reared from *Hibiscus rosa-sinensis* in Formosa, suggest an affinity with the Australian genus *Decatopseustis*. The uncus is broad and rounded, the gnathos is a strong hook, and the slightly clavate valva is similar in shape to that of *Decatopseustis*. Distinguishing features, however, are the more strongly curved gnathos and the lack of short thick dorsal submarginal spines in the valva of *Phrixocrita* and the shape of the aedoeagus. The basal half of the aedoeagus in *Phrixocrita* is only slightly bulbous, with a diameter about twice that of the distal half, whereas in *Decatopseustis* the basal half is very strongly bulbous, almost globose. In addition, the antenna of the type of *Phrixocrita* has a well-developed basal pecten of four hair scales, while in *Decatopseustis* the pecten is represented by at most a single hair scale. In *Trachyedra* Meyr.,

with type species *T. xylomorpha* Meyr. from India, Meyrick stated there was a slight basal pecten, but the female type in the British Museum (Natural History) appears to be without a pecten. As the female genitalia also lack signa, the systematic position of the genus is in some doubt.

Thus the uncus and the gnathos, as well as characters of the valva, at once separate *Pectinophora*, *Pexicopia*, *Platyedra*, *Mometa*, *Anisoplaca*, *Phrixocrita*, *Metacaena*, and *Decatopseustis*.

Two species from Africa, *Platyedra erebodoxa* Meyr. and *P. cunctatrix* Meyr. are generically distinct from the genera mentioned above. The male uncus is rather similar to *Pectinophora*, but the gnathos is in the form of a strong hook as in *Platyedra*. The valvae are elongate and, in the latter species, three large spines occur on the dorsal margin. The signa of the bursa copulatrix are a pair of dentate bands, as in *Pexicopia*. *Platyedra piceicoma* Meyr., represented by a unique female type from Africa in the British Museum (Natural History), may be congeneric with *P. erebodoxa* and *P. cunctatrix*, or may be referable to *Pexicopia*. Mr. J. D. Bradley (personal communication) states that the signa are a pair of long, narrow, spined plates. There is a pecten of two hair scales on the left scape and three on the right. A more reliable generic placing awaits the discovery of the male.

The genitalia of the male types of two species in the British Museum (Natural History), *Platyedra cruenta* Meyr. from Palestine and *Gelechia sarcochroma* Walsingham from Socotra, indicate they have been wrongly associated with the *Platyedra* group of genera. The type of the former species has a strong basal pecten of 8 hair scales on the antenna, but the latter is without a pecten. The presence of an antennal pecten is therefore by no means diagnostic of the group of genera related to *Platyedra*, although it is variously developed in most of them. Nevertheless, a pecten is rarely present in other genera of the Gelechiidae. However, it does occur in the quite unrelated *Sitotroga* Heinemann and *Bryotropha* Heinemann. In the type species of the latter, *Gelechia terrella* Schiffermuller, one hair scale, representing a vestigial pecten, is usually present on the scape of the antenna.

Key to Australian Genera of Gelechiidae Associated with Malvaceae

1. Male genitalia with uncus tapering, gnathos elongate, tapering, tongue-like; female genitalia with signum represented by a pair of strong, heavily sclerotized hooks .... *Pectinophora* Busck

   Genitalia not so 2

2(1). Male genitalia with uncus bilobed, gnathos short, spatulate, valva trigonate; female genitalia with signum represented by a pair of scobinate or dentate patches .... *Pexicopia*, gen. nov.

   Genitalia not so 3

3(2). Male genitalia with costa separate, clavate, with a long spine at apex; forewing with R_1 from one-half cell, R_2 normal .... *Macracaena*, gen. nov.

   Male genitalia with valva entire, elongate, forewing with R_1 from before two-fifths cell, R_2 modified, nearly twice as broad as R_1 .... *Decatopseustis* Meyr.

Genus PECTINOPHORA Busck

Pectinophora Busck, 1917, J. Agric. Res. **9**: 346.

Type species *Depressaria gossypiella* Saunders, 1844 (by original designation).

Head smooth; antenna in male serrated and finely ciliated beneath, scape with pecten of 5–7 thick hair scales; labial palpi long, recurved, reaching beyond vertex, 2nd segment thickened beneath with roughened scales, usually furrowed, terminal segment shorter than 2nd, somewhat thickened with appressed scales,

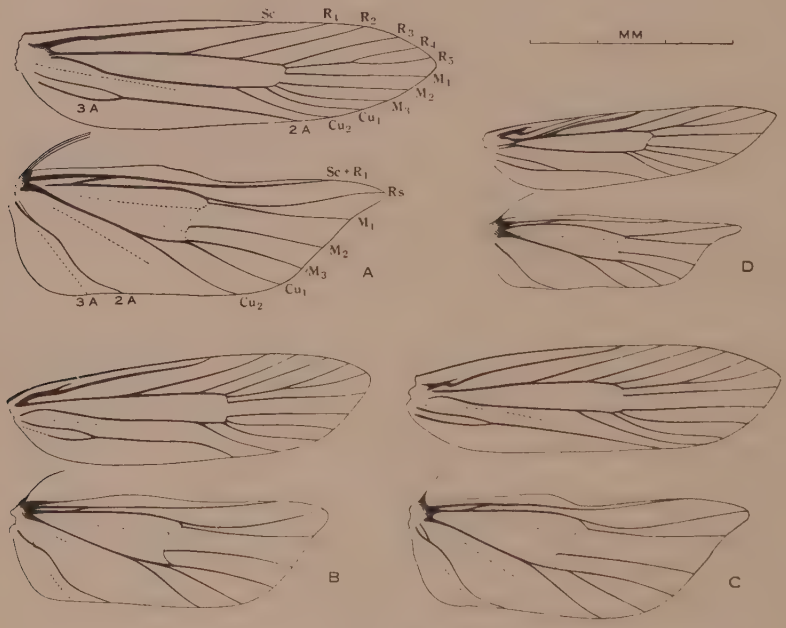

Fig. 1.—Wing venation of: *A*, *Pectinophora gossypiella* (Saund.), female, Wyndham, north-western Australia; *B*, *Pexicopia desmanthes* (Low.), male, Biloela, Qld.; *C*, *Macracaena adela*, sp. nov., paratype male, Springsure, Qld.; *D*, *Decatopseustis xanthastis* (Low.), male, Rockhampton, Qld.

apex acute. Forewing (Fig. 1*A*) elongate, R_1 from nearly two-thirds cell, base of R_2 slightly closer to R_3 than to R_1, R_3 from near upper angle of cell, R_4 and R_5 stalked, R_5 to costa, R_{4+5} from upper angle, M_3 from lower angle of cell, Cu_1 from just before angle, Cu_2 from before three-quarters cell. Hindwing (Fig. 1*A*) trapezoidal, costa strongly sinuate just beyond middle, apex produced, acute, termen sinuate; $Sc+R_1$ reaching costa beyond four-fifths, Rs to apex, M_1 closely approximated to Rs in basal one-quarter, M_2 almost parallel to M_1 and M_3, from just below middle of cell, M_3 and Cu_1 connate, from lower angle of cell, Cu_2 from before three-quarters cell.

Male genitalia (*Figs.* 2*A*, 2*B*).—Uncus tapering, apex rounded; gnathos elongate, tapering, with acute apex; valva entire, with costa nearly straight, dorsum concave, distal half about twice as broad as constricted middle, densely haired, with a bunch

of strong, inwardly directed, deciduous spines; aedoeagus swollen at base, with erect projection above distal orifice, cornuti present.

Female genitalia (*Fig.* 3*A*).—Bursa copulatrix with signum a pair of strong hooks with tapering points.

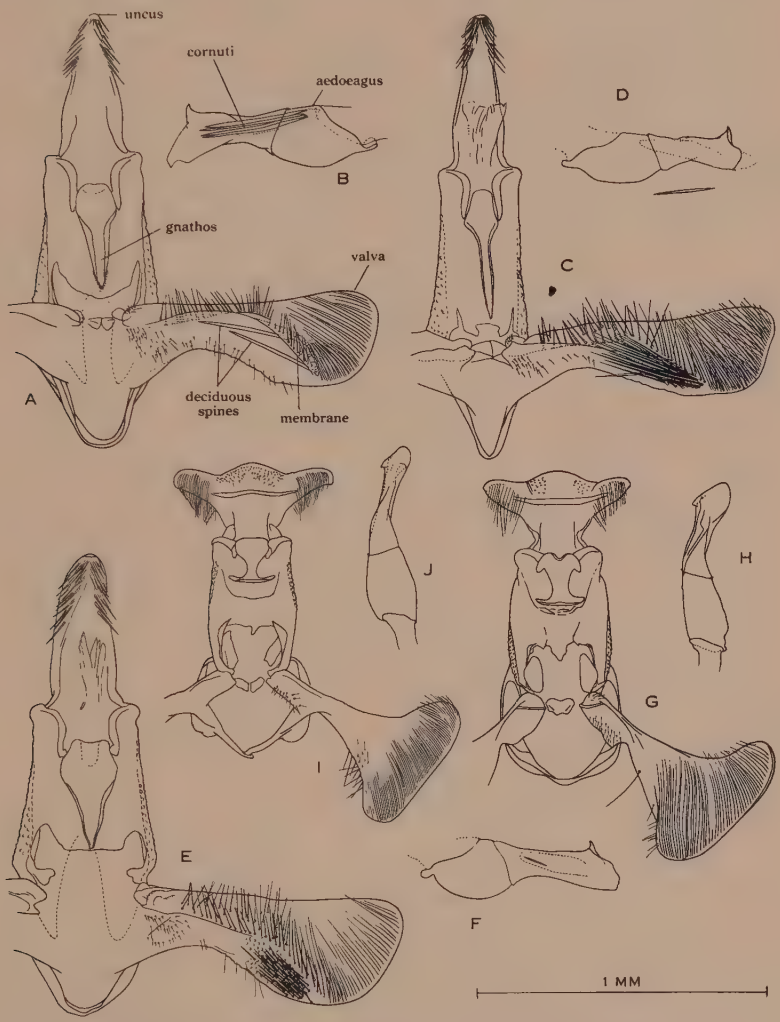

Fig. 2.—Male genitalia of: *A*, *B*, *Pectinophora gossypiella* (Saund.), Wyndham, north-western Australia; *C*, *D*, *P. scutigera* (Hold.), Mt. Larcom, Qld.; *E*, *F*, *P. endema*, sp. nov., paratype, Rockhampton, Qld.; *G*, *H*, *Pexicopia mimetica*, sp. nov., allotype, Grey Range, south-western Qld.; *I*, *J*, *P. desmanthes* (Low.), Trangie, N.S.W.

The three species of *Pectinophora* can only be separated morphologically by characters of the genitalia in both sexes. In Australia *P. gossypiella* is so far recorded only from the Northern Territory and north-western Australia, but is widely distributed in other cotton-growing countries such as the United States, India, and

Africa (Commonwealth Institute of Entomology 1952). *P. scutigera* is distributed through coastal and subcoastal Queensland, and Holdaway (1926) records it from

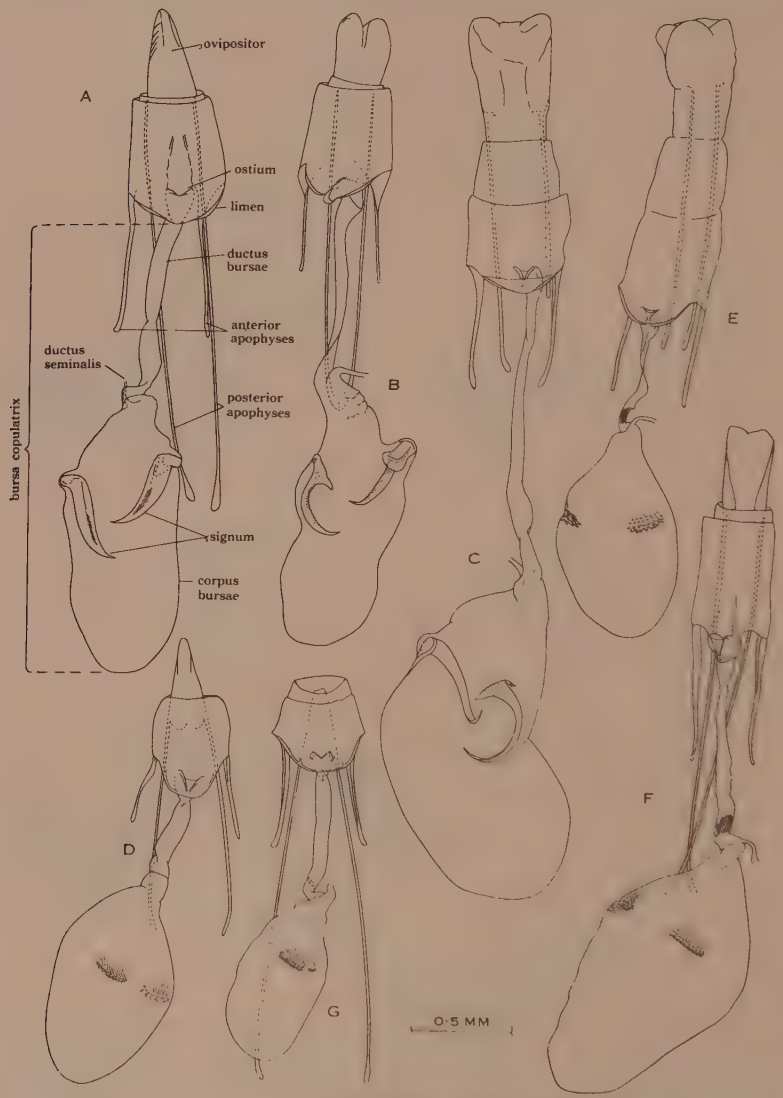

Fig. 3.—Female genitalia of: *A*, *Pectinophora gossypiella* (Saund.), Wyndham, north-western Australia; *B*, *P. scutigera* (Hold.), Biloela, Qld.; *C*, *P. endema*, sp. nov., paratype, Rockhampton, Qld.; *D*, *Pexicopia mimetica*, sp. nov., holotype, Grey Range, south-western Qld.; *E*, *P. desmanthes* (Low.), Broken Hill, N.S.W.; *F*, *P. nephelombra* (Meyr.), Emerald, Qld.; *G*, *P. dascia*, sp. nov., allotype, Rockhampton, Qld.

Papua. Dr. J. F. Gates Clarke (personal communication) has taken the species in Micronesia and the author has seen a female specimen from the Northern Territory.

P. endema has been recorded from central and southern Queensland and central New South Wales.

The larvae, known as pink bollworms, feed on the buds, flowers, and seed capsules of Malvaceae. Those of *P. gossypiella*, one of the most important pests of cotton in North America, Africa, and India, often enter a larval diapause within the cotton seed. This habit has been largely responsible for its accidental introduction in seed to new cotton-growing areas. In areas where *P. gossypiella* occurs, treatment of cotton seed by heat or by fumigation has therefore been uniform practice to prevent dispersal and establishment of this pest. In contrast to this, *P. scutigera* does not normally enter diapause within the seed for Sloan (1946) examined many thousands of cotton seeds at a ginnery in central Queensland, where it occurs as a minor pest of cotton, without finding any living larvae or pupae. The heat treatment of plant seed before distribution to growers in this area was therefore unnecessary. As there have been no authentic records of *P. gossypiella* from Queensland, it is essential that quarantine measures be maintained to prevent its entry from north-western Australia or from abroad. The larvae of the third species, *P. endema*, have never been recorded from cotton, although they occur commonly in the seed capsules of native *Hibiscus* spp. growing in the cotton-growing areas of Queensland.

Key to Species of the Genus Pectinophora

1. Male valva with a very dense bunch of short thin deciduous spines; female with posterior apophyses shorter than ductus bursae ..... *P. endema*, sp. nov.

   Male valva with bunch of less numerous and longer deciduous spines; female with posterior apophyses much longer than ductus bursae 2

2. Male valva with bunch of broad and long deciduous spines arising beneath membrane; female signa a pair of broad, flattened, and slightly curved hooks ..... *P. gossypiella* (Saund.)

   Male valva with bunch of thin shorter deciduous spines not arising beneath membrane; female signa a pair of slender strongly curved hooks ..... *P. scutigera* (Hold.)

Description of Species

Pectinophora gossypiella (Saunders)

Figs. 1*A*, 2*A*, 2*B*, 3*A*

Depressaria gossypiella Saunders, 1844, Trans. Ent. Soc. Lond. **3**: 284.

Gelechia gossypiella (Saunders) Meyrick, 1905, J. Bombay Nat. Hist. Soc. **16**: 592. Durrant, 1912, Bull, Ent. Res. **3**: 203. Walsingham, 1907, Fauna Hawaii **1**: 731.

Platyedra gossypiella (Saunders) Meyrick, 1918, Exot. Microlep. **2**: 136. Turner, 1919, Proc. Roy. Soc. Qd. **31**: 124. Meyrick, 1922, Ark. Zool. **14**(15): 3; 1925, in Wytsman, Gen. Ins. **184**: 85, pl. 2, fig. 30. Holdaway, 1926, Bull. Ent. Res. **17**: 67.

Pectinophora gossypiella (Saunders) Busck, 1917, J. Agric. Res. **9**: 346. Holdaway, 1929, Proc. 4th Int. Ent. Congr. Ithaca, N.Y. (1928), p. 74; 1929, Bull. Ent. Res. **20**: 179.

Type.—The location of the type is not known. The original type material came from Broach, western India.

Male genitalia.—Gnathos moderately broad at base; longitudinal bundle of deciduous spines long, stout, and with base covered by membrane; aedoeagus with cornuti long, more than half length of aedoeagus.

Female genitalia.—Posterior apophyses about twice length of ductus bursae; signa broad, flattened, and slightly curved, with finely serrated edge, but without lateral dentations.

Expanse.—Male 12·7–17·6 mm, female 14·0–20·0 mm.

Specimens examined.—20 ♂♂, 34 ♀♀.

Distribution.—The author has examined specimens from Egypt, India, Hawaii, United States, and north-western Australia. Holdaway's (1926) records of *P. gossypiella* from north-western Australia, based on larvae, can now be confirmed from a study of the genitalia of adults from this area. Some of the localities given by Meyrick (1925) remain to be checked, especially Far Eastern localities such as the Philippines, China, and Japan. NORTHERN TERRITORY: Batchelor, Darwin, Katherine, Lee Point, Stapleton. WESTERN AUSTRALIA: Broome, Wyndham.

Comments.—Holdaway (1926, 1929*b*) has shown that a series of characters of the adults and larvae clearly separate *P. gossypiella* and *P. scutigera*. It should be pointed out, however, that the "spicule-like strengthening" of the aedoeagus referred to by Holdaway (1929*b*) is in reality one of a series of deciduous cornuti present in all three species of *Pectinophora*. They differ in length in the three species approximately in proportion to the length of the spines in the longitudinal bundle of the valva, and are therefore a useful diagnostic character when present. These characters, together with the shape of the gnathos, are the most reliable in the male. The longitudinal bundle of spines and the cornuti of the aedoeagus are the shortest and most numerous in *P. endema*, while the gnathos is broadest in *P. endema* and narrowest in *P. scutigera*.

Compared with *P. endema*, the signa of the bursa copulatrix in *P. gossypiella* are shorter, broader, and more flattened, with a serrated edge. The signa in *P. scutigera*, which are also serrated, have the sides covered in small dentations as well. The posterior apophyses in both *P. gossypiella* and *P. scutigera* are relatively much longer than in *P. endema*.

At times *P. gossypiella* damages experimental cotton crops at Darwin and at the C.S.I.R.O. research stations at Kimberley, W.A., and Katherine, N.T. (Mertin 1952). At Kimberley it has also been reared from the native *Hibiscus ficulneus*.

PECTINOPHORA SCUTIGERA (Holdaway)

Figs. 2*C*, 2*D*, 3*B*

Platyedra scutigera Holdaway, 1926, Bull. Ent. Res. **17**: 67.

Pectinophora scutigera (Holdaway) Holdaway, 1929, Bull. Ent. Res. **20**: 179; 1929, Proc. 4th Int. Ent. Congr. Ithaca, N.Y. (1928), p. 74.

Types.—According to Holdaway (1929*b*) the holotype, a larval skin, was deposited in the British Museum (Natural History) and paratypes, also larval skins, in the U.S. National Museum and Australian Commonwealth Collection, C.S.I.R.O., Canberra. He also stated (1929*b*) that plesiotypes, male genitalia mounts, were lodged in the same museums. Enquiries at these institutions have failed to bring these types to light.

Type locality.—Queensland, probably Biloela in the Callide Valley.

Male genitalia.—Gnathos narrow at base; spines of longitudinal bundle dense, moderately long and slender, without membrane covering base; aedoeagus with cornuti slightly more than one-quarter length of aedoeagus.

Female genitalia.—Posterior apophyses about twice length of ductus bursae; signa slender and strongly curved, with serrated edge and lateral dentations.

Expanse.—Male 14·8–18·8 mm, female 15·2–20·6 mm.

Specimens examined.—13 ♂♂, 14 ♀♀.

Distribution.—Coastal and subcoastal Queensland, Papua, Micronesia. There is a single female from Darwin, collected by G. F. Hill, in the Division of Entomology Museum, C.S.I.R.O. However, further specimens from this area are necessary to confirm this record. The author has examined the genitalia of specimens from the following Australian localities: QUEENSLAND: Ayr, Biloela, Bundaberg, Cairns, Gladstone, Lowood, Port Douglas, Redcliffe, Rockhampton, Yeppoon. NORTHERN TERRITORY: Darwin.

Comments.—Holdaway (1926, 1929*a*, 1929*b*) has discussed in detail the characters of the larvae, pupae, and adults and the distribution and plant hosts of this species. In Queensland it is a minor pest of cotton, especially in areas where crops are grown in close proximity to its native malvaceous hosts. It is primarily a pest of late-maturing bolls, becoming less important when the native hosts growing near cultivation are eliminated and since the growing of ratoon crops has been discouraged (Anon. 1945).

PECTINOPHORA ENDEMA,* sp. nov.

Figs. 2*E*, 2*F*, 3*C*; Plate 1, Fig. 1

Types.—Holotype male labelled "13 mls. N. of Rockhampton, Q., emg. 28 Aug. 1952, I. F. B. Common, ex. *Hibiscus divaricatus*" (genitalia slide No. G157); allotype female with same label data but emerging Sept. 9, 1952 (genitalia slide No. G159); eight male and three female paratypes from Rockhampton, Qld., reared from seed capsules of *H. divaricatus* and *H. heterophyllus* between August 3 and September 21, 1952 (I. F. B. Common); five male and three female paratypes from 10 miles north of Wowan, Qld., reared from seed capsules of *H. divaricatus* between April 11 and May 10, 1957 (I. F. B. Common).

Holotype, allotype, and 11 paratypes in Division of Entomology Museum, C.S.I.R.O., Canberra; one male and one female paratype deposited in each of the following museums: British Museum (Natural History), United States National Museum, Australian Museum, Sydney, and the South Australian Museum, Adelaide.

Holotype male.—Head with scales dull ochreous, tipped with dark fuscous; labial palpi ochreous, 2nd segment with anterior roughened scales tipped with dark fuscous, apical segment with basal half and subapical band dark fuscous; antennae fuscous with pecten of 2 hair scales remaining on right and 6 on left scape. Thorax dull ochreous irrorated with dark fuscous, tegulae ochreous, dark fuscous towards base. Forewing ochreous with dark fuscous markings, obscured by dark fuscous irroration, especially in dorsal half; a narrow sub-basal fascia, a suffused spot at one-fifth, another on fold just beyond one-third, and a third just beyond one-half, a broad transverse fascia at two-thirds followed by dull ochreous costal and tornal spots,

*ἐνδημος, native.

apical portion beyond heavily suffused with dark fuscous; cilia grey, basal half fuscous. Hindwing dull grey, cilia dull grey, ochreous basally. Expanse 18·0 mm.

Allotype female.—Similar to male, but with slightly more obscured markings. Pecten of 5 hair scales on each scape. Expanse 16·1 mm.

Male genitalia.—Gnathos broad at base, tapering to point; spines in longitudinal bundle numerous, short, and slender, without membrane covering base; aedoeagus with cornuti slender and very short, about equal in length to diameter of aedoeagus at narrowest part.

Female genitalia.—Posterior apophyses shorter than ductus bursae; signa elongate, strongly curved tapering hooks, with smooth edge and without lateral dentations.

Expanse.—Paratypic series: male 15·2–21·2 mm, female 16·1–21·2 mm.

Specimens examined.—22 ♂♂, 15 ♀♀.

Distribution.—The species occurs in coastal and subcoastal areas from central Queensland to central New South Wales. The genitalia of specimens from the following localities have been examined: QUEENSLAND: Bribie I., Brisbane, 30 miles E. of Emerald, Gin Gin, Marmor, Rockhampton, 10 miles N. of Wowan. NEW SOUTH WALES: Upper Allyn R.

Comments.—The description of the coloration and pattern of this species is essentially similar to that of *P. gossypiella* and *P. scutigera*. The extent of the dark fuscous suffusion varies considerably within each species. As with the other species, the hair scales of the antennal pecten are easily denuded, but as many as 7 may be present.

Adults have been reared from *H. divaricatus*, *H. heterophyllus*, and *H. diversifolius* from several localities, but none have so far been reared from cotton, despite the fact that the larvae occur commonly on *Hibiscus* in the cotton-growing areas. In subcoastal areas, the larvae of *P. endema* have been taken in native hosts much more commonly than those of *P. scutigera*.

This is probably the species which Holdaway (1926) referred to as *Platyedra* sp. (scarlet larva). In addition to the *Hibiscus* species already listed, he recorded larvae in seed capsules of *H. splendens*, from localities in central and southern Queensland. However, a specimen from Charleville which Turner (1921) misidentified as *P. gossypiella* is not the adult of the scarlet larvae, as Holdaway (1926) supposed, but *Pexicopia pheletes*, sp. nov.

Genus PEXICOPIA,* gen. nov.

Type species *Gelechia desmanthes* Lower, 1898.

Head smooth; antenna in male finely ciliated beneath, scape with pecten of 2–7 hair scales (often partially or completely denuded); labial palpi long, recurved, reaching beyond vertex, 2nd segment thickened, scales beneath often roughened and sometimes furrowed, terminal segment about equal in length to 2nd, slightly thickened with appressed scales, apex acute. Forewing (Fig. 1*B*) elongate, costa very gently curved, apex rounded, termen oblique, R_1 from just beyond half cell, base

**pexus*, comb, pecten; *copia*, plenty; feminine.

of R_2 twice as far from R_1 as from R_3, R_3 from near upper angle of cell, R_4 and R_5 stalked, R_5 to costa, R_{4+5} from upper angle, M_3 from just above lower angle of cell, M_3, Cu_1, and Cu_2 diverging towards margin of wing, Cu_1 from lower angle, Cu_2 from well beyond three-quarters cell. Hindwing (Fig. 1*B*) trapezoidal, costa sinuate just beyond middle, apex slightly produced, rounded, termen slightly sinuate; $Sc+R_1$ reaching costa at four-fifths, *Rs* to costa just before apex, M_1 closely approximated to *Rs* in basal quarter, M_2 subparallel to M_1 and M_3, closer to M_3 than to M_1, M_3 and Cu_1 closely approximated at base, connate or short-stalked, from lower angle of cell, Cu_2 from beyond three-quarters cell.

Male genitalia (*Figs.* 2*I*, 2*J*).—Uncus broad with lateral elongate hairy lobes; gnathos with short arms, united at centre and broadly spatulate distally; tegumen with membranous projection beneath gnathos; valva entire, trigonate, costa strongly concave, often with swelling at base bearing 1 or 2 strong setae, dorsum concave or almost straight; vinculum flanged; aedoeagus slightly swollen or almost cylindrical in basal half, constricted towards orifice, with barb-like projection above orifice, without cornuti.

Female genitalia (*Fig.* 3*E*).—Ductus bursae usually with sclerotized thickening near junction of ductus seminalis; bursa copulatrix with signa a pair of scobinate or dentate patches.

The species referred to this genus form a compact group, the genitalia of which can be readily distinguished from those of related genera. The bilobed uncus and spatulate gnathos in the male, and the paired scobinate or dentate signa in the female, clearly separate *Pexicopia* from *Pectinophora*, *Platyedra*, *Mometa*, *Macracaena*, *Anisoplaca*, and *Decatopseustis*.

There are slight differences in the venation and the shape of the wings between *Pexicopia* and *Pectinophora*. In the hindwing of *Pexicopia*, the costa is less sinuate and the apex less produced. The wings in *Macracaena* are very similar to *Pexicopia* but *Decatopseustis* may be distinguished by the position of R_1 in forewing, and the produced apex of hindwing.

The genus appears to be developed to the greatest extent in the more arid inland areas of Australia where it replaces *Pectinophora*. Extensive collecting and some rearing of larvae attacking seed capsules of various species of Malvaceae in western New South Wales and south-western Queensland has yielded a series of *Pexicopia* species but no *Pectinophora*. Similar collecting has not been attempted in north-western Queensland or inland Northern Territory, but similar results might be expected. The genus is also represented in Africa by *Mometa chlidanopa* Meyr. from Uganda (holotype male in the British Museum, genitalia slide No. BM262), and in Europe by *Tinea malvella* Hübn. Dr. J. F. Gates Clarke (personal communication) has studied the genitalia of *Gelechia melitolicna* Meyr. (Caradja and Meyrick 1935) from China and states that they are scarcely distinguishable from those of *malvella*. This species appears therefore to be correctly referred to *Pexicopia* also. Careful collecting and rearing in both Africa and Australia will probably add greatly to the number of known species.

The 16 species here recognized from Australia are not easily separated. Four species have conspicuous black and ochreous transverse fasciae of the forewings,

but most of the remainder have sombre markings. The genitalia in both sexes provide excellent generic characters, but the specific differences, though usually significant, are not great. For this reason, genitalic characters are introduced only sparingly in the key. Further, it has not been possible to study the genitalia of *P. euryanthes* and *P. epactaea*, while some of the other species are known only from one sex. In most species the males are on the average slightly larger than the females.

Seven of the Australian species were previously referred to *Gelechia* Hübn. They are not at all closely related to the Australian species *Gelechia anthochra* Low. and *Psoricoptera melanoptila* Low., both of which were also referred to *Gelechia* by Meyrick (1925). Until further critical revisionary work is possible, these two species must remain in *Gelechia*, and their genitalia certainly indicate a relationship to the group of genera to which *Gelechia* belongs.

The author has so far succeeded in rearing only one species, *P. proselia*, from *Notoxylinon australis* (Malvaceae). *P. chlidanopa* (Meyr.) was reared from seed capsules of *Hibiscus* in Uganda. *P. malvella* Hübn. atacks the seed capsules of hollyhocks (*Althaea rosea*) and *Malva*, and at times attacks cotton (Goloviznin 1937). Other Australian species have been taken resting conspicuously in sunlight on the upper surface of the leaves of malvaceous plants.

Key to Australian Species of the Genus Pexicopia

1. Forewing dark fuscous or bronzy fuscous, without irroration, and with conspicuous ochreous, pinkish ochreous, ochreous yellow, or ochreous orange transverse fasciae . . 2
   Forewing not so 7
2(1). Head orange, thorax entirely dark fuscous . . . . . *P. mimetica*, sp. nov.
   Head and thorax ochreous or brassy ochreous 3
3(2). Head and thorax brassy ochreous 4
   Head and thorax ochreous 5
4(3). Forewing with fasciae ochreous yellow . . . . . *P. nephelombra* (Meyr.)
   Forewing with fasciae dull ochreous . . . . . *P. diasema*, sp. nov.
5(3). Forewing with 2 transversely placed confluent ochreous spots near base . . . . . *P. euryanthes* (Meyr.)
   Forewing not so 6
6(5). Forewing with 3rd transverse pale fascia complete . . . . . *P. desmanthes* (Low.)
   Forewing with 3rd transverse pale fascia represented by a triangular costal spot and small spot on tornus . . . . . *P. proselia*, sp. nov.
7(1). Forewing brownish ochreous with diffuse white fasciae or fasciae absent . . . . . *P. catharia*, sp. nov.
   Forewing not so 8
8(7). Forewing whitish ochreous with dark irrorated, or suffused, fasciae 9
   Forewing not so 10
9(8). Forewing with bright orange suffusion near base of costa . . . . . *P. arenicola*, sp. nov.
   Forewing without orange suffusion near base of costa . . . . . *P. cryphia*, sp. nov.
10(8). Forewing black, with very indistinct suffused ochreous fasciae . . . . . *P. dascia*, sp. nov.
   Forewing not so 11
11(10). Forewing without fasciae, or fasciae only very slightly indicated by dark fuscous irroration 12
   Forewing with 1 or 2 fasciae defined 14

12(11). Forewing with black subcostal and subdorsal spots near base, female genitalia with limen broad and heavily sclerotized ..... *P. bathropis* (Meyr.)
Forewing without subcostal and subdorsal spots near base, female genitalia with limen narrow 13

13(12). Forewing narrow, hindwing broader than forewing ..... *P. pycnoda* (Low.)
Forewing broader, hindwing equal in breadth to forewing ..... *P. epactaea* (Meyr.)

14(11). Forewing dull ochreous or greyish ochreous, heavily suffused with dark fuscous 15
Forewing ochreous brown or ochreous grey with dark fuscous irroration, except on costa, which is often reddish ..... *P. dictyomorpha* (Low.)

15(14). Forewing without fascia at one-third ..... *P. paliscia*, sp. nov.
Forewing with fascia at one-third ..... *P. pheletes*, sp. nov.

Pexicopia mimetica,* sp. nov.

Figs. 2*G*, 2*H*, 3*D*; Plate 1, Fig. 2

Types.—Holotype female and allotype male labelled "Grey Range, 5 mls. W. of Tickalara, S.W. Q'ld., 14.xi.49, I. F. B. Common" (genitalia slides Nos. G53 and G52), in Division of Entomology Museum, C.S.I.R.O., Canberra.

Holotype female.—Head orange, labial palpi ochreous orange, 1st segment and basal quarter of 2nd segment dark fuscous, apical segment with a few fuscous scales near base and narrow incomplete subapical fuscous ring; antennae dark fuscous, pecten of 1 hair scale remaining on right and 4 on left scape. Thorax dark fuscous; legs fuscous, shading to ochreous, middle and posterior tibiae with ochreous medial and apical whorls, posterior tibiae with long whitish scales above. Forewing dark fuscous with ochreous orange markings; a broad transverse fascia at one-quarter, not reaching costa or dorsum; a 2nd broad transverse fascia just beyond one-half, with inner margin strongly convex above middle and outer margin bent outwards above and below middle; a triangle on costa beyond three-quarters, not reaching half way to tornus; cilia fuscous. Hindwing and cilia dark grey, M_3 and Cu_1 short-stalked. Expanse 13·5 mm.

Allotype male.—Similar to female, scaling rather damaged. Expanse 12·6 mm.

Male genitalia (*allotype*).—Projection on tegumen beneath gnathos long; valva with base of costa not swollen, dorsum concave, distal portion nearly as broad as length of valva; aedoeagus slightly swollen in basal half.

Female genitalia (*holotype*).—Ductus bursae without sclerotized thickening; ratio of length of posterior apophyses to length of ductus bursae 2·3.

Comments.—This species is most likely to be confused with *P. desmanthes*, *P. euryanthes*, and *P. proselia*, each of which has conspicuous whitish or yellowish transverse fasciae on a dark fuscous ground. However, the thorax of *P. mimetica* is completely dark fuscous, there are no basal pale markings on the forewing and the fascia at one-quarter does not reach the costa or the dorsum. The male genitalia are rather similar to those of *P. desmanthes*, but the female genitalia lack the sclerotized thickening in the ductus bursae which is present in most of the other species of *Pexicopia*. The ostium is also relatively larger in size.

*μιμητικος, imitative.

Pexicopia desmanthes (Lower), comb. nov.
Figs. 1*B*, 2*I*, 2*J*, 3*E*; Plate 1, Fig. 3

Gelechia desmanthes Lower, 1898, Proc. Linn. Soc. N.S.W. **23**: 51. Meyrick, 1904, Proc. Linn. Soc. N.S.W. **29**: 309; 1925, in Wytsman, Gen. Ins. **184**: 81.

Holotype.—A male labelled "Broken Hill, 1 November 1898, type", in the South Australian Museum. In his original description Lower states that his two specimens were collected at light in October.

Male.—Head ochreous; labial palpi ochreous, basal segment and basal quarter of 2nd segment fuscous, terminal segment with subapical fuscous ring and sometimes also fuscous on basal third or with some more general fuscous suffusion; antenna fuscous, sometimes with ochreous annulations towards base, pecten of up to 5 hair scales on scape. Thorax ochreous, anterior edge, base of patagia, and posterior spot dark fuscous; legs dark fuscous, tarsi mainly ochreous, middle and posterior tibiae with medial and apical whorls whitish, posterior tibiae with long scales above whitish. Abdomen fuscous above, anal tuft ochreous, apical half of tergites ochreous. Forewing dark fuscous with ochreous or pinkish ochreous markings; a very small basal spot; a transverse fascia at one-quarter, sometimes not touching costa, with concave inner and convex outer margins; a 2nd broad transverse fascia at one-half with rather irregular margins; a 3rd fascia from three-quarters costa to tornus, broad on costa, bent outwards and narrow or interrupted in middle; cilia fuscous. Hindwing and cilia fuscous.

Female.—Similar to male but with posterior end of abdomen fuscous.

Male genitalia.—Projection on tegumen beneath gnathos short; valva with base of costa not swollen, dorsum concave, distal portion nearly as broad as length of valva; aedoeagus slightly swollen in basal half.

Female genitalia.—Ductus bursae with sclerotized thickening present; ratio of length of posterior apophyses to length of ductus bursae 2·3.

Expanse.—Male 11·1–14·7 mm, female 9·6–13·8 mm.

Specimens examined.—25 ♂♂, 14 ♀♀.

Distribution.—Known from subcoastal and inland areas in central and southern Queensland, western New South Wales, north-western Victoria, and north-western Australia, from August to April. Specimens have been examined from the following localities: QUEENSLAND: Biloela, Charleville, Cunnamulla, Dalby, Injune, Kihee, Lawgi, Mitchell, Mundubbera, 22 miles S. of Noccundra. NEW SOUTH WALES: Bourke, Broken Hill, Mt. Boppy, Trangie. VICTORIA: Pyramid Hill. WESTERN AUSTRALIA: Wyndham.

Comments.—This appears to be the commonest species, with a wide distribution and occurring throughout the warmer months. In size it resembles *P. mimetica*, but the head is ochreous, not orange, and the thorax is ochreous with fuscous markings, not entirely fuscous. The dark fuscous ground colour of the forewing, with conspicuous ochreous or pinkish transverse fasciae, distinguishes it from all but *P. mimetica*, *P. euryanthes*, and *P. proselia*. *P. desmanthes* is a much smaller species than either *P. euryanthes* or *P. proselia* and, according to Meyrick (1922), it lacks the 2 transversely placed confluent spots near the base of the wing found in *P. euryanthes*. The fasciae in *P. proselia* are much broader than in *P. desmanthes*, and the 3rd

transverse fascia, which is usually entire in the latter, is represented only by costal and tornal spots.

Pexicopia euryanthes (Meyrick), comb. nov.

Gelechia euryanthes Meyrick, 1922, Ark. Zool. **14**(15): 3; 1925, in Wytsman, Gen. Ins. **184**: 81.

Holotype.—Meyrick's female type came from Noonkanbah, north-western Australia, and, according to Meyrick, was deposited in the Stockholm Museum. The authorities of that museum, however, have not been able to trace it.

Comments.—No specimens answering to Meyrick's description have been seen by the author. As Meyrick states, the species should be readily distinguished from *P. desmanthes* and therefore also from *P. mimetica* and *P. proselia*, by the 2 transversely placed confluent spots near the base of the forewing. The thorax of *P. euryanthes* is whitish ochreous without any posterior spot which occurs in both *P. desmanthes* and *P. proselia*, while the thorax of *P. mimetica* is entirely dark fuscous.

Pexicopia proselia,* sp. nov.

Figs. 5*A*, 6*I*, 6*J*; Plate 1, Fig. 4

Types.—Holotype male, allotype female (genitalia slides Nos. G38 and G39) and eight male and three female paratypes labelled "35 mls. W. of Kihee, S.W. Q'ld., 12.11.49, I. F. B. Common", one female paratype from same locality, reared 3.1.1950 from larva feeding in seed capsule of *Notoxylinon australis*. The holotype, allotype, and seven paratypes in the Division of Entomology Museum, C.S.I.R.O., Canberra. A pair of paratypes have been deposited in the British Museum (Natural History) and one male paratype in each of the United States National Museum, the Australian Museum, Sydney, and the South Australian Museum, Adelaide.

Holotype male.—Head ochreous; labial palpi ochreous, basal segment and basal third of 2nd segment fuscous on outer surface, apical segment with broad subapical fuscous band; antennae fuscous, apex of scape tinged with ochreous, pecten of 2 hair scales on each scape. Thorax ochreous, anterior half, basal third of patagia, and large posterior spot bronzy fuscous; legs ochreous with some fuscous suffusion on anterior femora, middle and posterior tibiae fuscous with ochreous medial and apical whorls, tarsi fuscous, apices of segments ochreous. Abdomen ochreous grey, ventral surface and anal tuft ochreous. Forewing bronzy fuscous with ochreous markings; very small basal spot; a broad transverse fascia at one-quarter, narrow on costa, inner margin almost straight, outer margin convex; a 2nd broad transverse fascia at one-half not quite reaching dorsum, inner margin convex, outer margin nearly straight but with slight indentation in middle; a triangular spot on costa at three-quarters and a small indistinct spot opposite it near tornus; cilia fuscous, apical third suffused with ochreous. Hindwing grey; cilia grey, suffused with ochreous towards apex; M_3 and Cu_1 connate. Expanse 19·2 mm.

*$\pi\rho o\sigma\eta\lambda\iota o\varsigma$, exposed to the sun.

Allotype female.—Similar to male but with ochreous areas tinged with dull pinkish orange. Expanse 18·9 mm.

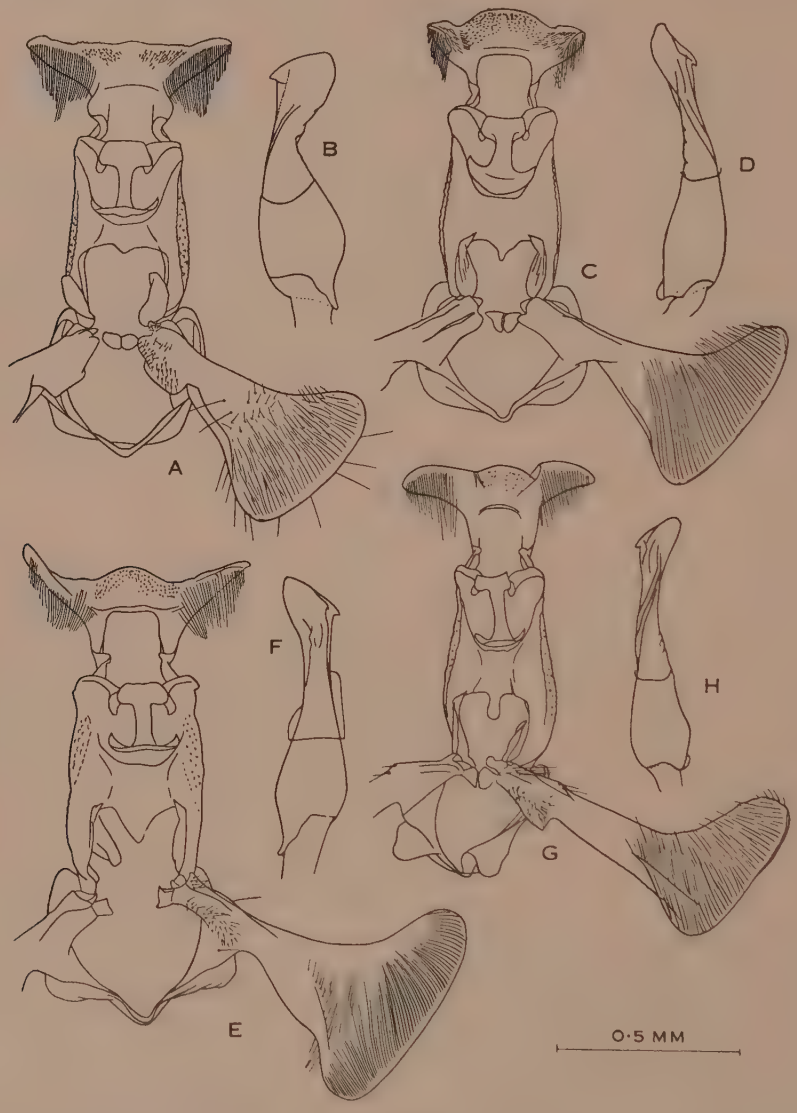

Fig. 4.—Male genitalia of: *A*, *B*, *Pexicopia nephelombra* (Meyr.), Rockhampton, Qld.; *C*, *D*, *P. catharia*, sp. nov., paratype, Tibooburra, N.S.W.; *E*, *F*, *P. cryphia*, sp. nov., paratype, Kihee, south-western Qld.; *G*, *H*, *P. dascia*, sp. nov., holotype, Mundubbera, Qld.

Male genitalia (*holotype*).—Projection of tegumen beneath gnathos rather short, obtuse; valva with base of costa strongly swollen, dorsum nearly straight, distal portion about three-quarters as broad as length of valva; aedoeagus cylindrical in basal half.

Female genitalia (*holotype*).—Ductus bursae with sclerotized thickening present; ratio of length of posterior apophyses to length of ductus bursae 1·9.

Expanse.—Paratypic series: male 17·7–20·1 mm, female 16·2–19·8 mm.

Comments.—The pale markings of the forewing vary from whitish ochreous to pale pinkish orange. The transverse markings also vary slightly in shape, but there is no difficulty in separating this conspicuous species from the remaining Australian species.

All but one of the typical series were taken at rest in bright sunlight on the upper surface of the leaves of the host plant, *Notoxylinon australis* (Malvaceae). Larvae were present in the green seed capsules of this plant and one female adult was subsequently reared. This specimen was smaller than the remainder (14·7 mm expanse), presumably because of the unfavourable conditions of rearing. Its measurement was therefore omitted when considering the normal expanse.

Pexicopia nephelombra (Meyrick), comb. nov.

Figs. 3*F*, 4*A*, 4*B*; Plate 1, Fig. 5

Gelechia nephelombra Meyrick, 1904, Proc. Linn. Soc. N.S.W. **29**: 309; 1925, in Wytsman, Gen. Ins. **184**: 81.

Gelechia chalcotora Turner, 1919, Proc. Roy. Soc. Qd. **31**: 123. Meyrick, 1925, in Wytsman, Gen. Ins. **184**: 81 (type locality: Toowoomba, Qld.; holotype ♂ (genitalia slide No. G48) in Division of Entomology Museum, C.S.I.R.O., Canberra) (syn. nov.).

Lectotype.—A male labelled "Duaringa, Queensland, G.B., 9.3.93" (genitalia slide No. BM2802) in the British Museum (Natural History), selected by J. D. Bradley.

Male.—Head brassy ochreous; labial palpi ochreous, basal segment and sometimes extreme base of 2nd segment dark fuscous, apical segment sometimes suffused with dark fuscous on outer surface, with broad subapical fuscous ring; antenna dark fuscous, with some bronzy scales near base above, scape with pecten of 5 hair scales when intact. Thorax brassy ochreous, usually suffused with fuscous, with dull fuscous posterior spot; legs fuscous, suffused with ochreous, middle and posterior tibiae with ochreous medial and posterior whorls, long hair-like scales above posterior tibiae ochreous. Forewing bronzy fuscous, or dark bronzy fuscous, with ochreous yellow markings; a broad suffused fascia at one-fifth, narrower on dorsum; a 2nd broad fascia at one-half, inner edge rather suffused, outer edge concave in middle; sometimes a few ochreous yellow scales at three-quarters forming a very indistinct costal spot or narrow transverse fascia; cilia dark fuscous, apical half dull ochreous yellow. Hindwing and cilia fuscous, M_3 and Cu_1 connate or short-stalked.

Female.—Similar to male, but with less conspicuous ochreous anal tuft.

Male genitalia.—Projection on tegumen beneath gnathos short, obtuse; valva without prominent swelling at base of costa, dorsum concave, with distal part about two-thirds as broad as length of valva; aedoeagus strongly swollen in basal half.

Female genitalia.—Ductus bursae with strong sclerotized thickening; ratio of length of posterior apophyses to length of ductus bursae 2·1.

Expanse.—Male 10·5–15·0 mm, female 12·3–14·4 mm.

Specimens examined.—16 ♂♂, 13 ♀♀.

Distribution.—North-western New South Wales, inland and subcoastal southern and central Queensland, extending to the dry coastal areas of central Queensland, from September to November and from February to April. Specimens have been examined from the following localities: QUEENSLAND: Bell, Duaringa, Emerald, Gogango, Injune, Lawgi, Mount Larcom, Mundubbera, Rockhampton, Roma, Toowoomba. NEW SOUTH WALES: Bourke, Tibooburra, Wanaaring.

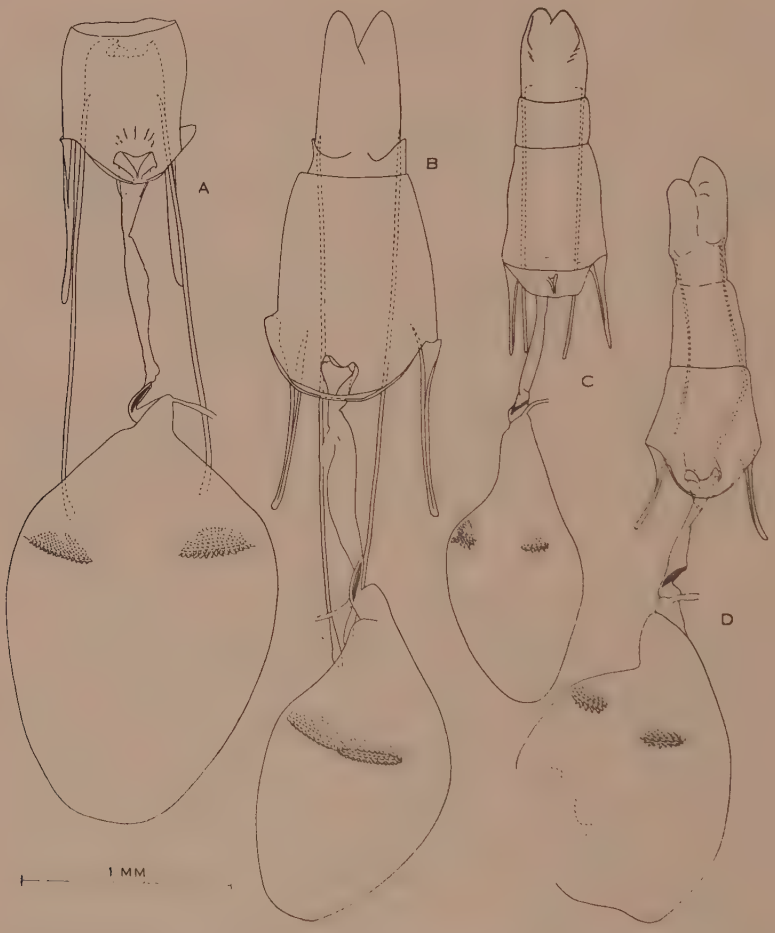

Fig. 5.—Female genitalia of: *A*, *Pexicopia proselia*, sp. nov., allotype, 35 miles W. of Kihee, south-western Qld.; *B*, *P. diasema*, sp. nov., allotype, Noccundra, south-western Qld.; *C*, *P. catharia*, sp. nov., allotype, Cobham Lake, N.S.W.; *D*, *P. pycnoda* (Low.), Broken Hill, N.S.W.

Comments.—The species appears to have a rather more restricted distribution than *P. desmanthes*, though both occur together in the subcoastal areas of central and southern Queensland.

The brassy ochreous head and thorax, together with the bronzy fuscous ground colour of the forewing and the ochreous yellow fasciae, distinguish the species from all

but *P. diasema*. It is much smaller than the latter and the markings are more distinct: the ground colour is usually darker and less suffused with ochreous yellow or orange ochreous; the fasciae are yellow ochreous, not dull ochreous; and whereas in *P. diasema* there is an indistinct narrow fascia at three-quarters forewing, this is usually represented by only a few ochreous yellow scales in *P. nephelombra*. In the male genitalia, the projection of the tegumen beneath the gnathos is short and obtuse in *P. nephelombra*, but long and slender in *P. diasema*. The aedoeagus is also more swollen than in other Australian species.

Pexicopia diasema,* sp. nov.

Figs. 5*B*, 6*C*, 6*D*; Plate 1, Fig. 6

Types.—Holotype male and allotype female labelled "7 mls. S. of Noccundra, S.W. Queensland, 13.11.49, I. F. B. Common" (genitalia slides Nos. G24 and G33). Three male and one female paratype labelled "30 mls. W. of Wanaaring, New South Wales, 29.10.49, I. F. B. Common". Holotype, allotype, and one pair of paratypes in the Division of Entomology Museum, C.S.I.R.O., Canberra; one male paratype deposited in the British Museum (Natural History) and another in the South Australian Museum.

Holotype male.—Head brassy ochreous, face whitish ochreous; labial palpi whitish ochreous, apical segment suffused with fuscous; antenna fuscous, pecten of 2 hair scales on right and 4 on left scape. Thorax brassy ochreous with slight greyish suffusion; legs whitish ochreous, middle tibiae and tarsi fuscous, posterior tibiae and tarsi suffused with fuscous on outer surface, medial and apical whorls and apices of tarsi of middle and posterior legs whitish ochreous, long hair-like scales above posterior tibiae whitish ochreous. Abdomen pale fuscous, suffused with ochreous beneath, anal tuft pale ochreous. Forewing dull bronzy fuscous, slightly suffused with orange ochreous, markings dull ochreous; a broad very indistinct basal fascia occupying basal third of wing, extending from near costa only two-thirds across wing; a 2nd broad fascia at one-half, connected to basal fascia near costa; a third less distinct and narrow fascia at three-quarters indistinctly extended to tornus; a fuscous spot just above fold at one-fifth, a 2nd in middle of wing at two-fifths, a 3rd on fold inwardly oblique from 2nd, and a 4th in middle of wing at end of cell; cilia at apex pale ochreous, remainder pale fuscous, shading to ochreous at tips. Hindwing pale fuscous, cilia as in forewing, M_3 and Cu_1 short-stalked. Expanse 17·1 mm.

Allotype female.—Similar to male but with less suffusion on fuscous ground colour and therefore 2nd, 3rd, and 4th spots partly obscured. Expanse 18·9 mm.

Male genitalia (*holotype*).—Projection on tegumen beneath gnathos long, slender, with rounded point; valva with slight swelling at base of costa, dorsum nearly straight, breadth of distal part about two-thirds length of valva; aedoeagus nearly cylindrical in basal half.

Female genitalia (*allotype*).—Ductus bursae with sclerotized thickening; ratio of length of posterior apophyses to length of ductus bursae 2·6.

Expanse.—Paratypic series: male 15·3–17·1 mm, female 13·8–18·9 mm.

*διασημος, distinct.

Comments.—Like *P. nephelombra,* the species is recognized by the brassy ochreous head and thorax. However, it is larger than that species and has less distinct markings of the forewing. The male genitalia are characterized by the elongate, narrow projection of the tegumen beneath the gnathos. The shape of the aedoeagus also distinguishes it from *P. nephelombra.*

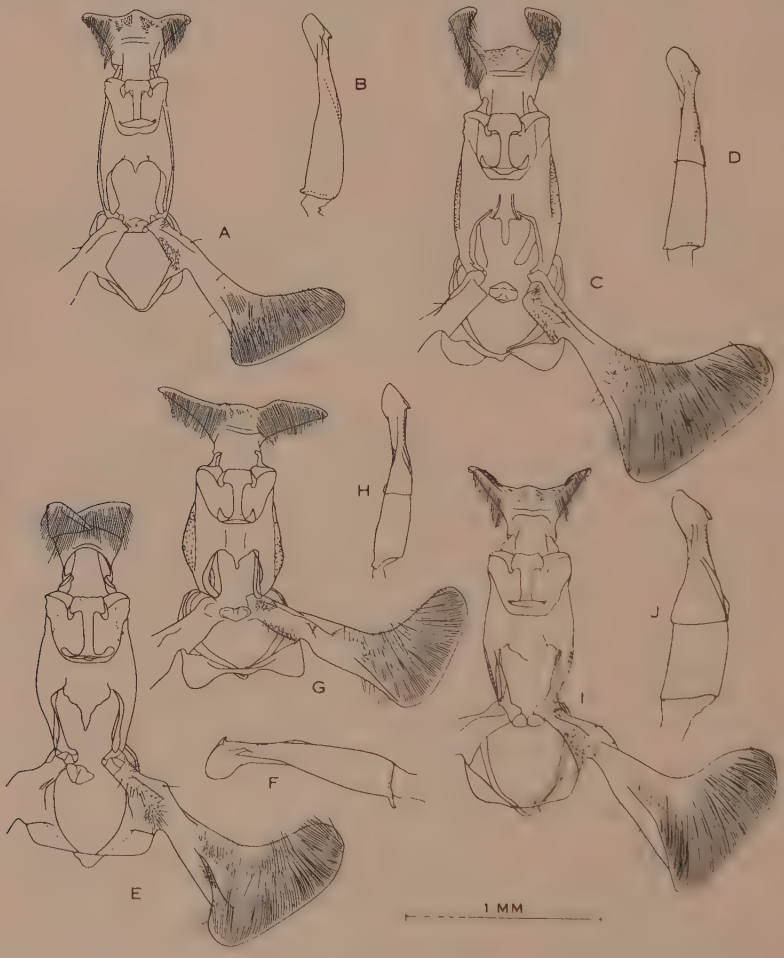

Fig. 6.—Male genitalia of: *A, B, Pexicopia dictyomorpha* (Low.), 70 miles W. of Cobar, N.S.W.; *C, D, P. diasema,* sp. nov., holotype, Noccundra, south-western Qld.; *E, F, P. paliscia,* sp. nov., holotype, Kihee, south-western Qld.; *G, H, P. pheletes,* sp. nov., holotype, Roma, Qld.; *I, J, P. proselia,* sp. nov., holotype, 35 miles W. of Kihee, south-western Qld.

Pexicopia catharia,* sp. nov.

Figs. 4*C*, 4*D*, 5*C*; Plate 1, Fig. 7

Types.—Holotype male (genitalia slide No. G223) and one male paratype labelled "40 mls. E. of Tibooburra, New South Wales, 31.10.49, I. F. B. Common";

*καθαριος, neat.

allotype female (genitalia slide No. G30) labelled "Cobham Lake, 20 mls. S. of Milparinka, New South Wales, 17.11.49, I. F. B. Common"; one female paratype labelled "40 mls. S. E. of Nappamerry, S.W. Queensland, 5.11.49, I. F. B. Common"; all in the Division of Entomology Museum, C.S.I.R.O., Canberra. One female paratype labelled "Tibooburra, New South Wales, 15.11.49, I. F. B. Common", deposited in the British Museum (Natural History).

Holotype male.—Head white; labial palpi white, 2nd segment with slight fuscous suffusion near base on outer surface, terminal segment with subapical fuscous ring; antenna white, with fuscous annulations, scape suffused with fuscous, pecten of 7 hair scales on right and 5 on left scape. Thorax whitish ochreous; legs white, anterior and middle tibiae and tarsi suffused with fuscous, tarsal segments with white apices, middle tibiae with medial and apical whorls white. Abdomen whitish, suffused with fuscous below, ochreous towards base above, anal tuft white. Forewing whitish ochreous, distal two-fifths suffused with brown; basal half of costa white, with dark fuscous strigulae; white spot on costa at three-quarters which, together with some scattered white scales between it and tornus, suggests a diffuse transverse fascia; a brown suffused spot in middle of wing at end of cell; cilia white, basal half brownish ochreous, grey on costa near apex. Hindwing grey, darker distally, cilia very light grey, white near apex, M_3 and Cu_1 short-stalked. Expanse 14·7 mm.

Allotype female.—Similar to male but with brownish suffusion more general on forewing and thorax; more distinct diffuse white fascia at three-quarters and some scattered white scaling suggesting indistinct fasciae at one-quarter and one-half: right scape with pecten of 5 and left with 4 hair scales. Expanse 12·9 mm.

Male genitalia (*holotype*).—Projection of tegumen beneath gnathos broad at base with acute apex; valva without swelling at base of costa, dorsum nearly straight, breadth of distal part three-quarters length of valva; aedoeagus slightly swollen in basal half.

Female genitalia (*allotype*).—Ductus bursae with strong sclerotized thickening; ratio of length of posterior apophyses to length of ductus bursae 2·1.

Expanse.—Paratypic series: male 13·2–14·7 mm, female 12·9–13·5 mm.

Comments.—This is the palest of the Australian species. The diffuse white fasciae, which may be completely lacking, on a brownish ochreous background, at once distinguish it. From *P. cryphia* in which the head, thorax, and ground colour of the forewings are also very pale, it may be separated by the scarcity of distinct markings or spots on the forewing.

P. catharia is one of the species in which a pecten of 7 hair scales on the scape of the antenna is normal.

Pexicopia cryphia,* sp. nov.

Figs. 4*E*, 4*F*, 9*A*; Plate 1, Fig. 8

Types.—Holotype male, allotype female (genitalia slides Nos. G221 and G32), and three male and one female paratypes labelled "Kihee, 40 mls. N. of Noccundra, S.W. Queensland, 10.11.49, I. F. B. Common". Holotype, allotype, and two para-

*κρυφιος, hidden.

types in the Division of Entomology Museum, C.S.I.R.O., Canberra; one male paratype deposited in the British Museum (Natural History) and another in the South Australian Museum, Adelaide.

Holotype male.—Head whitish ochreous; labial palpi whitish ochreous, 2nd segment with faint suffusion of fuscous on outer surface near base; antenna fuscous,

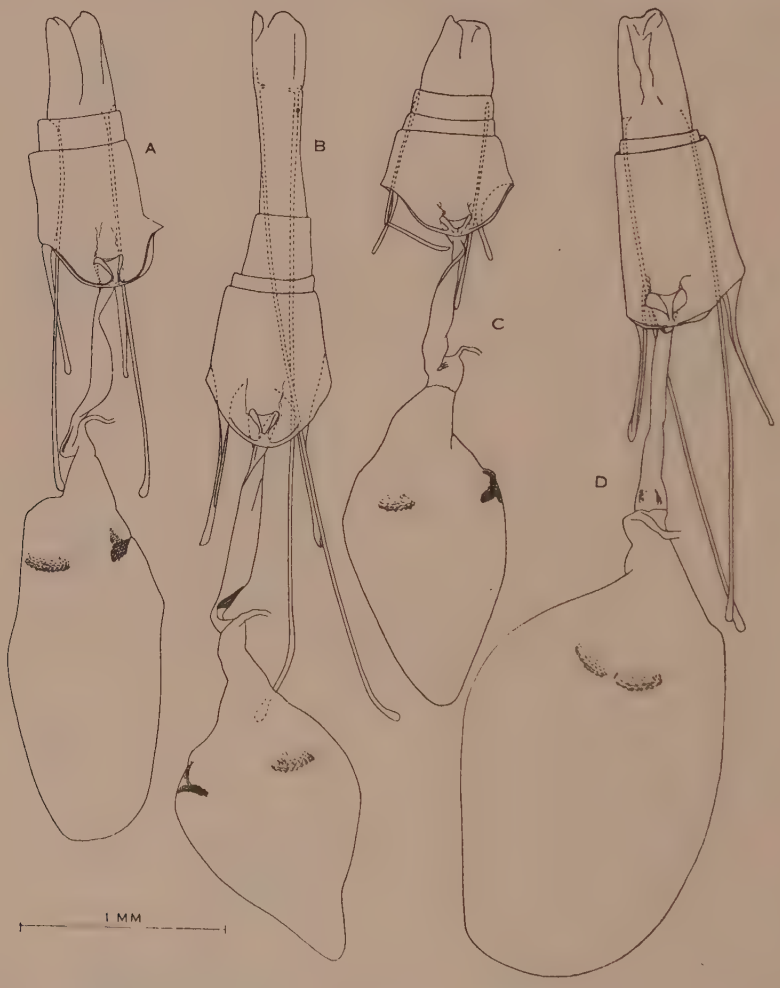

Fig. 7.—Female genitalia of: *A*, *Pexicopia arenicola*, sp. nov., holotype, Cobham Lake, N.S.W.; *B*, *P. dictyomorpha* (Low.), 70 miles W. of Cobar, N.S.W.; *C*, *P. pheletes*, sp. nov., allotype, Roma, Qld.; *D*, *P. paliscia*, sp. nov., allotype, Kihee, south-western Qld.

paler annulations, right scape with pecten denuded, left with only 1 hair scale. Thorax whitish ochreous, base of patagia and 3 small posterior spots dark ochreous; legs fuscous, middle and posterior legs with medial and apical whorls of tibiae and apices of tarsi whitish ochreous. Abdomen light fuscous, anal tuft whitish ochreous.

Forewing whitish ochreous, basal half of costa strigulated with fuscous, other markings dark ochreous grey; suffused basal patch to one-quarter, not extending below fold except for diffuse spot at base of dorsum; transverse suffused fascia at two-thirds, with a distinct rather darker spot in middle of inner edge and with outer edge bent outwards; 2 or 3 strigules between 1st and 2nd fasciae; area beyond 2nd fascia irrorated with dark ochreous grey, leaving a clear triangular spot of ground colour on costa; cilia whitish ochreous, irrorated with dark ochreous grey, fuscous on tornus. Hindwing grey, cilia grey, becoming whitish ochreous at apex, M_3 and Cu_1 connate. Expanse 15·0 mm.

Allotype female.—Similar to male but with markings of forewing more intense and area beyond 2nd fascia almost completely suffused with dark ochreous grey; scape of both antennae with 3 hair scales. Expanse 13·8 mm.

Male genitalia (*holotype*).—Projection of tegumen beneath gnathos broad at base, tapering to a broad rounded point; valva with slight swelling at base of costa, dorsum fairly concave, breadth of distal part three-quarters length of valva; aedoeagus swollen in basal half.

Female genitalia (*allotype*).—Ductus bursae short, with sclerotized thickening; ratio of length of posterior apophyses to length of ductus bursae 3·8.

Expanse.—Paratypic series: male 14·4–15·0 mm, female 13·8–14·1 mm.

Comments.—The whitish ochreous head, thorax, and ground colour of the forewing with inconspicuous markings distinguish the species from all but *P. cathariu*. The latter usually has the ground colour of the forewing suffused with brown and the fasciae when present are white.

Pexicopia arenicola,* sp. nov.

Fig. 7*A*; Plate 1, Fig. 9

Types.—Holotype female (genitalia slide No. G37) and two female paratypes labelled "Cobham Lake, 20 mls. S. of Milparinka, New South Wales, 17.11.49, I. F. B. Common". Holotype and one paratype in the Division of Entomology Museum, C.S.I.R.O., Canberra; one paratype deposited in the British Museum (Natural History).

Holotype female.—Head whitish ochreous, irrorated with dark fuscous; labial palpi whitish ochreous, 1st and 2nd segments irrorated with dark fuscous especially on outer surface, terminal segment with basal quarter and broad subapical band irrorated with dark fuscous; antennae dark fuscous with paler indistinct annulations, pecten of 5 hair scales on right and 6 on left scape, at extreme base. Thorax with anterior half whitish ochreous, strongly irrorated with dark fuscous, posterior half ochreous, with small fuscous spot on posterior margin; legs whitish ochreous, strongly irrorated with dark fuscous, middle and posterior legs with medial and apical whorls of tibiae and apices of tarsal segments whitish ochreous, long dorsal hair-like scales of posterior tibiae whitish ochreous. Forewing whitish ochreous irrorated with dark fuscous, suffused with ochreous beneath costa and with bright orange suffusion

**arenicola*, inhabiting a sandy place.

without irroration near base of costa, markings grey formed by heavy dark fuscous irroration; a small basal patch; a broad suffused transverse fascia at one-third; a 2nd transverse fascia at two-thirds; area beyond 2nd fascia heavily irrorated except for a triangular spot of ground colour on costa, very indistinctly connected to smaller spot on termen near tornus; basal three-fifths of costa strigulated with dark fuscous; cilia whitish ochreous, basal three-fifths irrorated with dark fuscous and with subapical dark fuscous band. Hindwing light fuscous, paler basally; cilia light grey, shading to whitish ochreous at apex, M_3 and Cu_1 short-stalked. Expanse 19·5 mm.

Female genitalia (holotype).—Ductus bursae with sclerotized thickening: ratio of length of posterior apophyses to length of ductus bursae 2·1.

Expanse.—Paratypic series: 19·2–19·8 mm.

Comments.—One of the largest species in the genus, *P. arenicola* may be distinguished from all others by the pale ground colour of the forewings, the grey transverse markings, and the area of bright orange suffusion near the base of the costa.

Pexicopia pheletes,* sp. nov.

Figs. 6*G*, 6*H*, 7*C*; Plate 1, Fig. 10

Types.—Holotype male, allotype female (genitalia slides Nos. G179 and G187) and three female paratypes labelled "12 mls. S. of Roma, Queensland, 28 Mar. 1957, I. F. B. Common"; one female paratype "12 mls. E. of Springsure, Queensland, 3 Apr. 1957, I. F. B. Common"; one female paratype "10 mls. N. of Emerald, Queensland, 4 Apr. 1957, I. F. B. Common". Holotype, allotype, and three paratypes in the Division of Entomology Museum, Canberra; one female paratype deposited in the British Museum (Natural History), and one female paratype in the South Australian Museum, Adelaide.

Holotype male.—Head fuscous; labial palpi dark fuscous, terminal segment dull ochreous with broad dark fuscous basal and subapical bands; antenna dark fuscous, pecten of 7 hair scales on right and 5 on left scape. Thorax dull greyish ochreous, heavily suffused with fuscous, especially near anterior margin and on basal half of patagia; legs dark fuscous, middle and posterior legs with medial and apical whorls of tibiae and apices of tarsal segments pale ochreous. Abdomen fuscous, anal tuft dull ochreous grey. Forewing dull greyish ochreous with dark fuscous markings largely obscured by more or less general dark fuscous suffusion, especially towards costa and dorsum; a small basal patch; a diffuse transverse fascia at one-third; a 2nd more distinct transverse fascia at two-thirds; apical quarter of wing dark fuscous; a diffuse spot on fold at one-fifth, a 2nd on fold within 1st fascia, and a 3rd at end of cell near inner edge of 2nd fascia; cilia ochreous grey, basal half darker. Hindwing and cilia dark fuscous, M_3 and Cu_1 connate. Expanse 17·1 mm.

Allotype female.—Similar to male, but with ground colour of forewing ochreous, fasciae more distinct; pecten of 5 hair scales on right scape, 1 hair scale on left. Expanse 16·8 mm.

Male genitalia (holotype).—Projection on tegumen beneath gnathos well developed, slender; valva with costa not swollen at base, dorsum nearly straight,

*φηλητης, deceiver.

breadth of distal portion about three-fifths length of valva; aedoeagus nearly cylindrical in basal half.

Female genitalia (allotype).—Ductus bursae short, with only slight sclerotized thickening; apophyses very short, ratio of length of posterior apophyses to length of ductus bursae 1·5.

Expanse.—Paratypic series: female 13·8–16·8 mm.

Specimens examined.—2 ♂♂, 8 ♀♀.

Comments.—This is an obscure species with coloration and markings not unlike species of *Pectinophora* and *Macracaena*. A female from Charleville, Qld., in the Division of Entomology Museum, C.S.I.R.O., was misidentified as *P. gossypiella* by Turner (1921). A second female from Queensland, without further data, was associated with specimens labelled *P. scutigera* by Turner. The genitalia in both sexes at once distinguish *P. pheletes* from *Pectinophora*. The male genitalia also readily separate it from *Macracaena*. The apex of the hindwings are more strongly produced in both of these genera than in *P. pheletes*. A male from Milmerran, Qld. (J. Macqueen) is also correctly referred to *P. pheletes*.

Pexicopia dascia,* sp. nov.

Figs. 3*G*, 4*G*, 4*H*; Plate 1, Fig. 11

Types.—Holotype male (genitalia slide No. G178) and one paratype male labelled "6 mls. N.W. of Mundubbera, Queensland, 8 Apr. 1957, I. F. B. Common"; allotype female (genitalia slide No. G54) "Rockhampton, Queensland, 23.2.48, I. F. B. Common"; one male paratype "12 mls. E. of Springsure, Queensland, 3 Apr. 1957, I. F. B. Common"; one female paratype "Lawgi, Queensland, 11 May, 1955, I. F. B. Common". Holotype, allotype, one male and one female paratype in the Division of Entomology Museum, C.S.I.R.O., Canberra; one male paratype deposited in the British Museum (Natural History).

Holotype male.—Head ochreous grey, irrorated with fuscous; labial palpi black, irrorated with grey, paler on inner surface, apical segment orange ochreous with basal third and broad subapical band black, irrorated with grey; antenna dark fuscous with some dull ochreous scales above, pecten of 7 hair scales on right and 5 on left scape. Thorax dark ochreous irrorated with dark fuscous; legs blackish, suffused with pale ochreous, middle and posterior legs with medial and apical whorls and apices of tarsal segments pale ochreous. Forewing black, basal two-thirds of scales dark grey which tends to show through the black as a dark grey irroration, markings ochreous; a suffused spot of dark ochreous at extreme base and an elongate subcostal dark ochreous spot near base; a transverse suffused fascia at one-quarter, outwardly curved and connected to subcostal spot; a 2nd transverse fascia at one-half, not reaching dorsum, with an indentation on outer edge; a triangular costal spot at three-quarters, extending almost half across wing; a small spot on tornus opposite costal spot; cilia grey, basal half black. Hindwing and cilia grey, M_3 and Cu_1 short-stalked. Expanse 11·1 mm.

*δασκιος, dark.

Allotype female.—Similar to male but with ground colour rather paler and fasciae more diffuse; pecten of 4 hair scales on right and 5 on left scape. Expanse 12·6 mm.

Male genitalia (*holotype*).—Projection on tegumen beneath gnathos elongate, thick, slightly constricted in middle, apex rounded; valva with base of costa slightly swollen, dorsum nearly straight, width of distal portion two-fifths length of valva, aedoeagus slightly swollen in basal half.

Female genitalia (*allotype*).—Ductus bursae with slight sclerotized thickening; apophyses long, ratio of length of posterior apophyses to length of ductus bursae 2·7.

Expanse.—Paratypic series: male 11·1–12·0 mm, female 10·5–12·6 mm.

Comments.—With *P. mimetica* and *P. desmanthes*, this is one of the smallest species in the genus. Unlike those species, however, the head and thorax are irrorated with dark fuscous and the ochreous transverse markings of the forewing are much less conspicuous. Superficially it suggests a small specimen of *P. pheletes*, but the apex of the hindwing in *P. dascia* is more produced and acute. The aedoeagus is more swollen basally and the valva is more slender with a small but distinct basal swelling of the costa.

The projection of the tegumen beneath the gnathos of the male distinguishes the male genitalia from other species, while the ductus bursae of the female has only a slight sclerotized thickening. A pecten of up to 7 hair scales may be present on the scape of the antenna.

Pexicopia paliscia,* sp. nov.

Figs. 6*E*, 6*F*, 7*D*; Plate 1, Fig. 12

Types.—Holotype male, allotype female (genitalia slides Nos. G21 and G22), and five female paratypes labelled "Kihee, 40 mls. N. of Noccundra, S.W. Queensland, 10.11.49, I. F. B. Common", one male paratype labelled "28 mls. N. of Tibooburra, N.S.W., 2.11.49, I. F. B. Common". Holotype, allotype, and four paratypes in the Division of Entomology Museum, C.S.I.R.O., Canberra; one female paratype deposited in the British Museum (Natural History), and another in the South Australian Museum, Adelaide.

Holotype male.—Head dull ochreous grey; labial palpi fuscous, apical half and inner surface of 2nd segment ochreous, terminal segment ochreous with basal quarter and broad subapical band dark fuscous; antenna fuscous with some paler scales above, pecten of 1 hair scale remaining on right and 2 on left scape. Thorax dull ochreous grey; legs fuscous, suffused with pale ochreous, middle legs with medial and apical whorls of tibiae and apices of tarsal segments pale ochreous, posterior legs with tibiae and tarsi pale ochreous. Abdomen fuscous, anal tuft ochreous. Forewing dull ochreous, suffused with fuscous, costa fuscous, strigulated with dark fuscous; a broad dark fuscous, outwardly curved fascia just beyond two-thirds, preceded and followed by small indistinct pale ochreous spots; apical sixth of wing dark fuscous; an indistinct dark fuscous spot at end of cell on inner edge of fascia; cilia fuscous,

*παλιακιος, dusky.

basal half darker. Hindwing and cilia fuscous, M_3 and Cu_1 connate. Expanse 22·5 mm.

Allotype female.—Similar to male; an indistinct dark fuscous spot on fold at one-third; some pale ochreous suffusion on fascia beneath costa; antennal pecten denuded. Expanse 19·8 mm.

Male genitalia (*holotype*).—Projection of tegumen beneath gnathos large, with broad base tapering to acute but rounded apex; valva with base of costa strongly swollen and bearing a stout seta, dorsum nearly straight, width of distal portion of valva two-thirds length of valva; aedoeagus nearly cylindrical in basal half.

Female genitalia (*allotype*).—Ductus bursae with slight sclerotized thickening; apophyses long, ratio of length of posterior apophyses to length of ductus bursae 2·9.

Expanse.—Paratypic series: male 19·2–22·5 mm, female 17·1–21·9 mm.

Comments.—This is the largest species referred to the genus and is characterized by the rather unicolorous forewings, the basal two-thirds of the wing being dull ochreous suffused with fuscous and without fasciae, while the outer one-third is largely dark fuscous. It is thus not similar to any other species. According to Meyrick's original description, the forewing of *P. epactaea* lacks transverse fasciae altogether. He also states that the hindwing of that species is equal in width to the forewing, whereas the hindwing of *P. paliscia* is distinctly broader than the forewing.

A male specimen in the Division of Entomology Museum, C.S.I.R.O., Canberra, taken by the author at Katanning, W.A., probably belongs to this species. As it is the only specimen of the genus *Pexicopia* known from south-western Australia, confirmation of its identity awaits the collection of further material from this area.

Pexicopia dictyomorpha (Lower), comb. nov.

Figs. 6*A*, 6*B*, 7*B*; Plate 1, Fig. 13

Gelechia dictyomorpha Lower, 1900, Proc. Linn. Soc. N.S.W. **25**: 49. Meyrick, 1904, Proc. Linn. Soc. N.S.W. **29**: 311.

Gelechia plinthodes Lower, 1920, Trans. Roy. Soc. S. Aust. **44**: 66 (type locality: Broken Hill, N.S.W.; holotype ♂, South Australian Museum) (syn. nov.).

Holotype.—A male labelled "Broken Hill, 4 September, 98" in the South Australian Museum.

Male.—Head ochreous grey, labial palpi dull ochreous, 2nd segment suffused with dark fuscous on outer surface, terminal segment with basal and subapical bands dark fuscous; antenna dull ochreous, suffused with fuscous and with indistinct fuscous annulations, scape brownish ochreous, pecten when intact with 5 hair scales. Thorax greyish ochreous to brownish ochreous, some dark fuscous scales towards posterior margin; legs ochreous or brownish ochreous, suffused with fuscous, middle and posterior legs with median and apical whorls and apices of tarsal segments pale ochreous. Forewing ochreous grey or ochreous brown, irrorated with fuscous except near costa which is often suffused with reddish, especially towards base, markings dark fuscous; basal half of costa with strong strigulations, a round sub-basal spot just above fold, a 2nd more suffused above fold at one-sixth; an indistinct transverse fascia at one-third sometimes represented only by 2 spots, 1 on fold at one-third and another in

centre of wing just beyond it; a 2nd indistinct transverse fascia at two-thirds, more distinct on costa, preceded by a round spot at end of cell; apical quarter of wing suffused with fuscous; cilia dull ochreous, basal half fuscous and with subapical fuscous line. Hindwing and cilia grey.

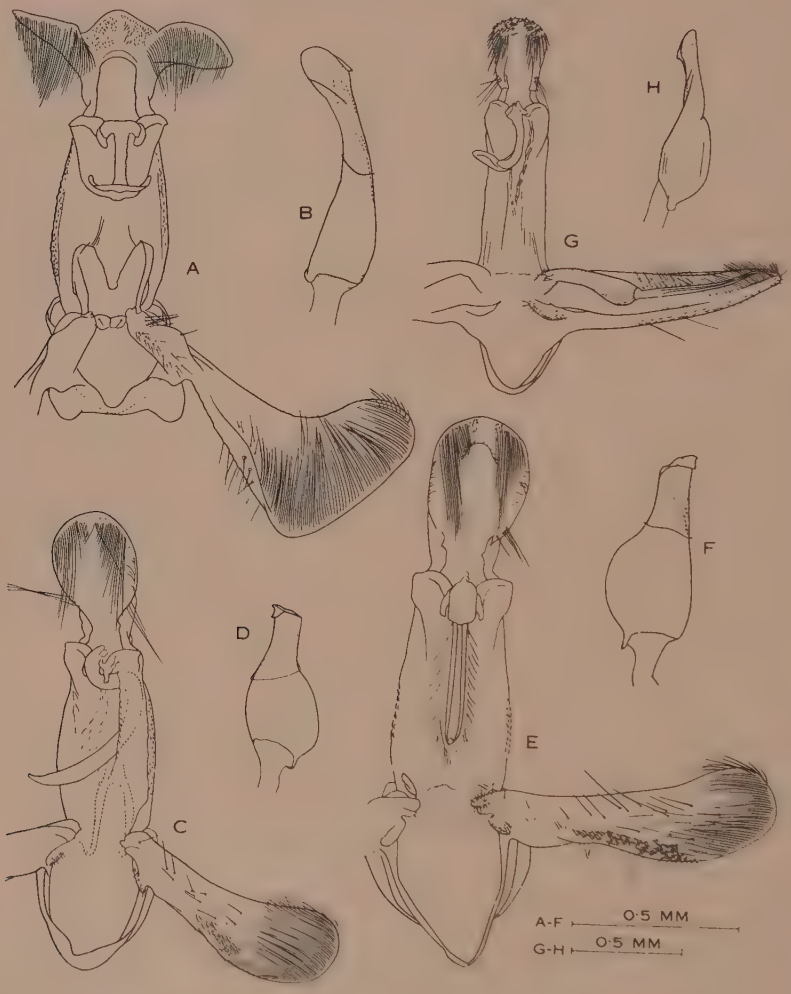

Fig. 8.—Male genitalia of: *A*, *B*, *Pexicopia pycnoda* (Low.), Broken Hill, N.S.W.; *C*, *D*, *Decatopseustis xanthastis* (Low.), Bell, Qld.; *E*, *F*, *D. cataphanes*, sp. nov., holotype, Condor Creek, A.C.T.; *G*, *H*, *Macracaena adela*, sp. nov., holotype, Springsure, Qld.

Female.—Similar to male.

Male genitalia.—Projection of tegumen beneath gnathos broad at base, tapering to point; valva with base of costa slightly swollen, dorsum nearly straight, breadth of distal portion two-thirds length of valva; aedoeagus nearly cylindrical in basal half.

Female genitalia.—Ductus bursae with sclerotized thickening, posterior apophyses very long, ratio of length of posterior apophyses to length of ductus bursae 3·5.

Expanse.—Male 13·5–18·9 mm, female 13·2–18·6 mm.

Specimens examined.—24 ♂♂, 18 ♀♀.

Distribution.—Known from central and south-western Queensland, western New South Wales, and north-western Australia. Specimens have been examined from the following localities: QUEENSLAND: Charleville, Comet, Duaringa, Durham Downs, Nappamerry, Noccundra, Yamala. NEW SOUTH WALES: 20 miles S.E. of Bourke, 42 miles W. of Bourke, Broken Hill, 70 miles W. of Cobar, Mt. Boppy, 65 miles N.W. of Nyngan, Tibooburra, Wanaaring. WESTERN AUSTRALIA: Wyndham.

Comments.—The markings of this species are exceeding variable, though most specimens may be recognized by the ochreous grey or ochreous brown ground colour of the forewing, often suffused with reddish towards the base of the costa, and with variable fuscous irroration. Sometimes diffuse irrorated transverse fasciae are present and spots may be distinct. In the male genitalia the projection of the tegumen beneath the gnathos is short and tapering to a point; the ductus bursae of the female genitalia has a sclerotized thickening.

A damaged male specimen of *Gelechia plinthodes*, from Broken Hill, one of Lower's original specimens, was kindly loaned to the author by Mr. N. B. Tindale of the South Australian Museum. A close examination of this specimen strongly suggests that the species is synonymous with *P. dictyomorpha*. However, the projection of the tegumen beneath the gnathos is much larger than in other specimens of *P. dictyomorpha* examined, although the size of this structure seems to be rather variable in this species.

PEXICOPIA EPACTAEA (Meyrick), comb. nov.

Gelechia epactaea Meyrick, 1904, Proc. Linn. Soc. N.S.W. **29**: 312; 1925, in Wytsman, Gen. Ins. **184**: 81.

Holotype.—A female labelled "L303, Highbury, South Australia, 4 December 91" in the South Australian Museum. Mr. N. B. Tindale, who provided this information, states that the unique type is without an abdomen.

Comments.—No specimens answering to Meyrick's description have been seen by the author. The size and coloration suggest a specimen of *P. dictyomorpha* with rather obscure markings. This species is known to vary considerably, but has not been recorded from South Australia. Further specimens of *P. epactaea* are required from the type locality for effective determination of the species.

PEXICOPIA PYCNODA (Lower), comb. nov.

Figs. 5*D*, 8*A*, 8*B*; Plate 1, Fig. 14

Gelechia pycnoda Lower, 1899, Proc. Linn. Soc. N.S.W. **24**: 97. Meyrick, 1904, Proc. Linn. Soc. N.S.W. **29**: 310; 1925, in Wytsman, Gen. Ins. **184**: 81.

Lectotype.—No specimen of this species in the South Australian Museum bears a type label, but Mr. N. B. Tindale has kindly informed the author that one labelled "Broken Hill", without date, which carried a name-label in Lower's handwriting, was probably intended to be the type. This specimen is here designated as the

lectotype. Altogether Mr. Tindale discovered nine of Lower's specimens labelled Broken Hill, without year of collection, which probably belonged to his original series of ten. One of the series was apparently sent to Meyrick, from which he made his 1904 description. Other specimens from Broken Hill, in the South Australian Museum, were collected by Lower after his original description was published.

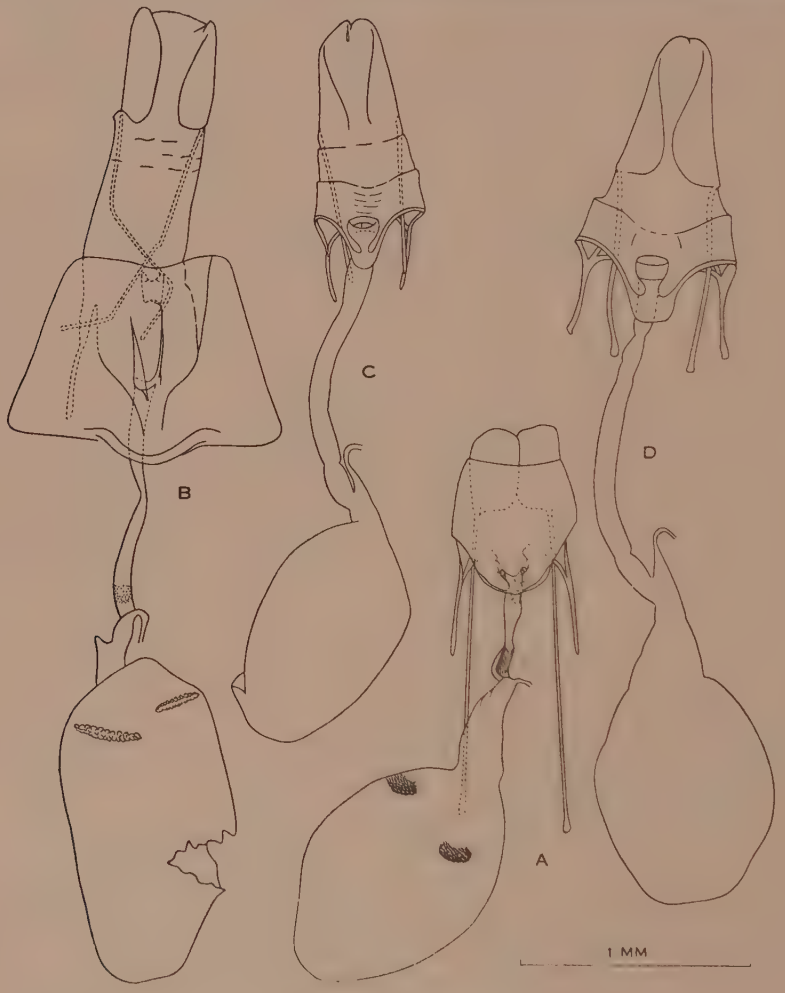

Fig. 9.—Female genitalia of: *A*, *Pexicopia cryphia*, sp. nov., allotype, Kihee, south-western Qld.; *B*, *P. bathropis* (Meyr.), lectotype, Sydney, N.S.W.; *C*, *Decatopseustis xanthastis* (Low.), Rockhampton, Qld.; *D*, *D. cataphanes*, sp. nov., allotype, Condor Creek, A.C.T.

Male.—Head dull ochreous suffused with fuscous; labial palpi dull ochreous, 2nd segment suffused with dark fuscous on outer surface, terminal segment with basal and subapical bands dark fuscous; antenna dull ochreous, suffused with fuscous; scape with pecten of 4–6 long hair scales. Thorax dull ochreous suffused with fuscous;

legs whitish ochreous heavily suffused with dark fuscous, middle and posterior legs with median and apical whorls and apices of tarsal segments whitish ochreous. Forewing narrower than hindwing, greyish ochreous, suffused with brown, fuscous, and dark fuscous; an indistinct fuscous spot on fold at one-third, and 3 slightly larger spots in centre of wing at one-third, one-half, and two-thirds, the last preceded by a diffuse spot of ground colour; these spots vary greatly in intensity and in some specimens are scarcely discernible; cilia greyish ochreous, basal half suffused with dark fuscous. Hindwing grey, cilia pale greyish ochreous.

Female.—Similar to male.

Male genitalia.—Projection on tegumen beneath gnathos large, with broad base and tapering to a broad rounded apex; valva with base of costa swollen and bearing a stout seta, dorsum nearly straight, width of distal portion three-fifths length of valva; aedoeagus slightly swollen in basal half.

Female genitalia.—Ductus bursae short, with sclerotized thickening; ratio of length of posterior apophyses to length of ductus bursae 2·4.

Expanse.—Male 14·4–18·3 mm, female 15·6–16·5 mm.

Specimens examined.—8 ♂♂, 4 ♀♀.

Distribution.—Known from south-western Queensland and western New South Wales. Specimens from the following localities have been examined: QUEENSLAND: Charleville. NEW SOUTH WALES: Broken Hill, Trangie, Walgett.

Comments.—The exceedingly narrow forewings of this species readily distinguish it from the remainder. The markings of the forewings are very indistinct in most specimens. The male genitalia are very similar to those of *P. dictyomorpha*, but the projection of the tegumen beneath the gnathos is much larger.

PEXICOPIA BATHROPIS (Meyrick), comb. nov.

Fig. 9*B*

Gelechia bathropis Meyrick, 1904, Proc. Linn. Soc. N.S.W. **29**: 310; 1925, in Wytsman, Gen. Ins. **184**: 81.

Lectotype.—A female labelled "Sydney, N.S. Wales, 30/8/84" in the British Museum (Natural History), genitalia slide No. BM2829, designated by J. D. Bradley.

Female genitalia (*lectotype*).—Limen broad, heavily sclerotized and constricted anteriorly; ductus bursae with slight sclerotized thickening; anterior edge of 7th abdominal sternite with curved fold in middle; apophyses short, ratio of length of posterior apophyses to length of ductus bursae 1·1.

Comments.—The lectotype is the only specimen of this species examined by the author, although Meyrick recorded a second female from Adelaide. The broad, heavily sclerotized limen of the female gentialia does not occur elsewhere in the genus and probably indicates that it is wrongly placed here. However, the correct generic position of the species will not be clear until the male is collected. Two females from Lord Howe I., with genitalia somewhat similar to those of *P. bathropis*, but differing from one another, are in the Division of Entomology Museum, C.S.I.R.O. Canberra. They are possibly congeneric with *P. bathropis*.

Genus MACRACAENA,* gen. nov.

Type species *Macracaena adela*, sp. nov.

Head smooth; antenna in male finely ciliated beneath, scape with pecten of about 4 hair scales; labial palpi long, recurved, reaching beyond vertex, 2nd segment thickened beneath with roughened scales, with central furrow, terminal segment shorter than 2nd, somewhat thickened with appressed scales, apex acute. Forewing (Fig. 1*C*) elongate, R_1 from one-half cell, base of R_2 two-thirds distance between R_1 and R_3, R_3 from before upper angle of cell, R_4 and R_5 stalked, R_5 to costa, R_{4+5} from upper angle, M_3 from lower angle of cell, Cu_1 from just before angle, Cu_2 from just beyond three-quarters cell. Hindwing (Fig. 1*C*) trapezoidal, costa strongly sinuate in middle, apex produced, acute, termen sinuate; $Sc+R_1$ reaching costa at four-fifths, *Rs* to apex, M_1 approximated to *Rs* in basal quarter. M_2 almost parallel to M_1, but much closer to M_3, M_3 and Cu_1 short-stalked, from lower angle of cell, Cu_2 from beyond three-quarters cell.

Male genitalia (*Figs.* 8*G*, 8*H*).—Uncus slightly spatulate, rounded at apex; gnathos a strong hook, with sickle-like blade in basal two-thirds, then slightly spatulate; valva elongate, with costa separate, in form of clavate protuberance with a long spine at apex, valvula tapering; aedoeagus bulbous at base, then tapering, with erect projection above orifice.

The genus is superficially very close to both *Pectinophora* and *Pexicopia*. There are, however, slight differences in the venation and the costa of the hindwing is rather more sinuate than in *Pexicopia*, while the apex of the hindwing is not so produced as in *Pectinophora*. In general appearance the type species might easily be mistaken for a species of either of these genera.

The male genitalia at once distinguish *Macracaena* from all other related genera. The hook-like gnathos, with its slightly spatulate tip, together with the form of the costa of the valva, is very distinctive. In both *Macracaena* and *Platyedra* the costa is separate and greatly developed; in the former it is clavate with a very long spine at the tip, while in the latter it is large and hooked, with 4 or 5 spines near its tip. The apical spine of the costa in *Macracaena* has longitudinal striations, suggesting that it may have had a composite origin. The basal swelling of the costa in certain species of *Pexicopia* may be the counterpart of the separate costal development in *Macracaena*.

Nothing is known of the early stages of *M. adela*, the only species so far collected.

Macracaena adela,† sp. nov.

Figs. 1*C*, 8*G*, 8*H*; Plate 1, Fig. 15

Types.—Holotype male and paratype male labelled "12 mls. E. of Springsure, Q., 3 Apr. 1957, I. F. B. Common" (genitalia slides Nos. G191 and G189) in the Division of Entomology Museum, C.S.I.R.O., Canberra.

*μακρα, long; ἀκαινη, spine; feminine.

†ἀδηλος, obscure.

Holotype male.—Head dull greyish ochreous, suffused with fuscous; labial palpi with 2nd segment dark fuscous, inner surface whitish, terminal segment pale ochreous with basal and subapical bands dark fuscous; antenna dark fuscous, with annulations and apex of scape dull ochreous, right scape with pecten of 3 and left with pecten of 2 long hair scales. Thorax fuscous, suffused with dull ochreous; legs dark fuscous, fore and middle legs with apices of segments pale ochreous, hind tibiae and tarsi pale ochreous, suffused with fuscous on outer surface. Forewing fuscous, suffused with dull ochreous and dark fuscous; without fasciae; a blackish spot near base of costa, followed by a larger ochreous spot; another blackish spot at base of dorsum; further blackish spots on fold at one-third, and in middle of wing at two-fifths, one-half, and three-fifths, the area between the last two spots ochreous; cilia grey, basal half mixed with dark fuscous. Hindwing grey; cilia grey, ochreous at base. Expanse 14·1 mm.

Male genitalia (*holotype*).—Apex of uncus with several short thick spines; valva with clavate protuberance of costa about two-fifths length of valvula, apical spine sinuate, about three-fifths length of valvula; aedoeagus without cornuti.

Expanse.—Paratype male 14·4 mm.

Comments.—Though the female of this species is not known, the characters of the male genitalia are so conspicuous that the description of the species and genus is given for comparison with the other Australian genera of this group. It is possible that a single female taken near Roma, superficially similar to the males described above, belongs to the same species. The genitalia are similar to *Pexicopia*, but differ from those of the females of *P. pheletes*, to which it bears a superficial resemblance. The hindwing is also more produced as in *M. adela*. However, the details of the forewing pattern differ somewhat from the male of *M. adela* and the expanse is rather greater. Until the sexes can be associated with more certainty, it seemed unwise to describe this female.

Genus DECATOPSEUSTIS Meyrick

Decatopseustis Meyrick, 1925, in Wytsman, Gen. Ins. **184**: 140.

Type species *Gelechia xanthastis* Lower, 1896 (by original designation and monotypy).

Head smooth; antenna in male finely ciliated beneath, scape with pecten represented by a single long hair scale, sometimes denuded; labial palpi long, recurved, reaching beyond vertex, 2nd segment thickened with appressed scales, terminal segment about equal in length to 2nd, slender, apex acute. Forewing (Fig. 1*D*) elongate; in male with R_1 from before one-third cell, R_2 modified, nearly twice as broad as R_1 and approximated to R_1 for most of its length; in female with R_1 from two-fifths, R_2 from two-thirds cell; in both sexes R_3 from beyond four-fifths cell, R_4 and R_5 stalked, R_5 to costa, R_{4+5} from near upper angle, M_1 straight, from near upper angle, M_2 closer to M_3 than to M_1, M_3 from lower angle, M_2, M_3, Cu_1, and Cu_2 equally spaced at base, Cu_1 and Cu_2 from just before lower angle of cell.

Hindwing (Fig. 1*D*) trapezoidal, costa slightly sinuate just beyond middle, apex produced, acute, termen sinuate; $Sc+R_1$ reaching costa just beyond two-thirds, *Rs* to costa just before apex, M_1 approximated to *Rs* at base, M_2 almost parallel to M_1 and M_3, from below middle of cell, M_3 from lower angle, Cu_1 approximated at base to M_3, Cu_2 from three-quarters cell.

Male genitalia (*Figs.* 8*C*, 8*D*).—Uncus spatulate, rounded; gnathos a large sickle-shaped hook; valva entire, with costa slightly concave, dorsum concave to beyond one-half, then convex, distal half of valva rounded, much broader than near base and densely haired, a series of short, thick, submarginal spines along central portion of dorsum; aedoeagus bulbous at base, orifice narrow with a small, erect projection at apex above orifice.

Female genitalia (*Fig.* 9*C*).—Limen produced anteriorly; ostium cup-like, connected to limen by a narrow sclerotized "stem"; ductus bursae without sclerotized thickening; apophyses short, ratio of posterior apophyses to ductus bursae 0·6; bursa copulatrix with signum absent.

The genitalia of the two species of *Decatopseustis* are strikingly similar and at once distinguish the genus from other related genera. The venation too is distinctive, and the two species have a similar facies, including yellow forewings with dark transverse markings. The larval hosts are unknown but, as both species have been taken in bright sunlight resting on leaves of Malvaceae, it is probable that these plants will prove to be their hosts.

The modification of R_2 in the forewing of the male is unusual and does not occur in any other genus studied. Meyrick's (1925) "subhyaline streak" in the male, with R_2 absent, undoubtedly refers to this vein. It is sparsely clothed with pale-coloured scales, giving the effect of a subhyaline streak. The single long hair scale on the scape of the antenna was overlooked by Meyrick or had been denuded in his specimens. It is usually present in specimens of both *D. xanthastis* and *D. cataphanes*.

Key to Species of the Genus Decatopseustis

Forewing with apical fascia broad, area of ground colour between it and 2nd fascia narrow .....*D. xanthastis* (Low.)

Forewing with apical fascia narrow, area of ground colour between it and 2nd fascia broad .....*D. cataphanes*, sp. nov.

Decatopseustis xanthastis (Lower)

Figs. 1*D*, 8*C*, 8*D*, 9*C*; Plate 1, Fig. 16

Gelechia xanthastis Lower, 1896, Trans. Roy. Soc. S. Aust. **20**: 168.
Acanthophila xanthastis (Lower) Meyrick, 1904, Proc. Linn. Soc. N.S.W. **29**: 306.
Decatopseustis xanthastis (Lower) Meyrick, 1925, in Wytsman, Gen. Ins. **184**: 168.

Type.—The original description was based upon three male specimens from Rockhampton, Qld., in December. The type male is in the South Australian Museum, Adelaide.

Male genitalia.—Dorsum of valva with less than 20 short thick spines.

Female genitalia.—Limen narrowly rounded anteriorly.

Expanse.—Male 9·7–12·9 mm, female 9·7–13·0 mm.

Specimens examined.—24 ♂♂, 4 ♀♀.

Distribution.—Subcoastal central and southern Queensland, extending to the coast in central Queensland. Its distribution in New South Wales is obscure but a single specimen has been taken by the author at Canberra in southern New South Wales. Specimens from the following localities have been examined: QUEENSLAND: Banana, Bell, Carnarvon Range, Comet, Injune, Rockhampton, Roma, Rosewood, Yeppoon, Yamala, Yarraman. AUSTRALIAN CAPITAL TERRITORY: Canberra.

Comments.—Lower's (1896) and Meyrick's (1904) descriptions are quite adequate to distinguish this conspicuous species. From *D. cataphanes* it is readily separated by its smaller size, and the more distinct purplish fuscous transverse fasciae on a rather deeper yellow ground colour. The apical fascia of *D. xanthastis* is also much broader, leaving only a narrow transverse strip of ground colour between it and the 2nd fascia. The genitalia in the male are very similar, but in *D. xanthastis* the valva has fewer dorsal submarginal spines than in *D. cataphanes*. The female genitalia of the two species are also very similar, but the limen in *D. xanthastis* is rounded in front, whereas in *D. cataphanes* it is broader and somewhat flattened in front.

The species occurs commonly, along with *Pexicopia desmanthes* and *P. nephelombra*, in central Queensland amongst *Sida* sp. and other malvaceous plants. One specimen was taken by the author at Yamala, in bright sunlight, resting on the upper surface of a leaf of a low-growing *Hibiscus*. Further collecting will no doubt show that its distribution includes subcoastal New South Wales.

DECATOPSUESTIS CATAPHANES,* sp. nov.

Figs. 8*E*, 8*F*, 9*D*; Plate 1, Fig. 17

Types.—Holotype male labelled "Five Fords, Condor Creek, 2,500 ft., A.C.T., 31.1.1955, I. F. B. Common" (genitalia slide G192), in the Division of Entomology Museum, C.S.I.R.O., Canberra. Allotype female (genitalia slide G217), eight male and four female paratypes from the same locality on February 5, 1958; one female paratype from same locality on January 27, 1958 (I. F. B. Common).

Holotype, allotype, and eight paratypes in the Division of Entomology Museum, C.S.I.R.O., Canberra; one male and one female paratype deposited in the British Museum (Natural History), and one male paratype each in the Australian Museum, Sydney, the National Museum of Victoria, Melbourne, and the South Australian Museum, Adelaide.

Holotype male.—Head pale yellow; labial palpi pale yellow, distal segment with a few fuscous scales towards apex; antenna fuscous with indistinct yellowish annulations, scape pale yellow beneath, without pecten. Thorax pale yellow, fuscous posteriorly, anterior edge of patagia narrowly fuscous; legs pale ochreous, fore and middle tibiae fuscous with pale ochreous medial and apical bands, hind tibiae dull fuscous with broad medial and apical bands and long dorsal scales pale ochreous, tarsi

*καταφανης, conspicuous.

fuscous with apices of segments pale ochreous. Forewing pale yellow, markings fuscous; a sub-basal fascia, narrow in middle, broad on dorsum and costa, continuing as a suffused costal streak to 2nd fascia; 2nd fascia at three-fifths, narrow in middle, broad on costa and dorsum, the dorsal half of inner margin dark fuscous; 3rd fascia apical, rather suffused, extending from just before apex to one-half termen; cilia pale ochreous, fuscous on tornus and apical half of termen. Hindwing and cilia fuscous. Expanse 15·3 mm.

Allotype female.—Similar to male but with ground colour brighter and markings more distinct; antennal pecten represented by a single hair scale on right scape. Expanse 17·3 mm.

Male genitalia (*holotype*).—Valva with 24–32 dorsal submarginal spines.

Female genitalia (*allotype*).—Limen broad and truncate anteriorly.

Expanse.—Paratypic series: male 15·3–17·3 mm, female 16·1–17·3 mm.

Comments.—The genitalia in both sexes are very similar to those of *D. xanthastis*, but the two species are readily distinguished by the markings of the forewing. In particular the apical fascia in *D. cataphanes* is quite small, leaving a broad area of the ground colour between it and the 2nd fascia. Also the markings are duller than in *D. xanthastis* and lack the purplish hue.

Several of the type series were taken at rest in bright sunlight on the upper surface of the leaves of *Plagianthus pulchellus* var. *tomentosus* (Malvaceae), which is most probably the larval host.

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Explanation of Plate 1

Fig. 1.—*Pectinophora endema*, sp. nov., holotype male, Rockhampton, Qld.

Fig. 2.—*Pexicopia mimetica*, sp. nov., holotype female, Grey Range, south-western Qld.

Fig. 3.—*P. desmanthes* (Low.), male, Biloela, Qld.

Fig. 4.—*P. proselia*, sp. nov., holotype male, 35 miles W. of Kihee, south-western Qld.

Fig. 5.—*P. nephelombra* (Meyr.), male, Rockhampton, Qld.

Fig. 6.—*P. diasema*, sp. nov., holotype male, Noccundra, south-western Qld.

Fig. 7.—*P. catharia*, sp. nov., holotype male, 40 miles E. of Tibooburra, N.S.W.

Fig. 8.—*P. cryphia*, sp. nov., holotype male, Kihee, south-western Qld.

Fig. 9.—*P. arenicola*, sp. nov., holotype female, Cobham Lake, N.S.W.

Fig. 10.—*P. pheletes*, sp. nov., holotype male, Roma, Qld.

Fig. 11.—*P. dascia*, sp. nov., allotype female, Rockhampton, Qld.

Fig. 12.—*P. paliscia*, sp. nov., holotype male, Kihee, south-western Qld.

Fig. 13.—*P. dictyomorpha* (Low.), male, 70 miles W. of Cobar, N.S.W.

Fig. 14.—*P. pycnoda* (Low.), male, Broken Hill, N.S.W.

Fig. 15.—*Macracaena adela*, sp. nov., holotype male, Springsure, Qld.

Fig. 16.—*Decatopseustis xanthastis* (Low.), male, Yarraman, Qld.

Fig. 17.—*D. cataphanes*, sp. nov., holotype male, Condor Creek, A.C.T.

List of Genera and Species

REVISION OF THE PINK BOLLWORMS OF COTTON

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